McGraw-Hill Publishing Company, Inc. JULY, 1938 Price 35c. per copy

AVIATION

The Oldest Aeronautical Publication

RADIO EQUIPMENT FOR TOMORROW'S TRANSPORT PLANES

BENDIX RADIO
STANDARD OF THE AVIATION INDUSTRY

The modern long range transport planes are bringing with them new requirements for adequate, up to date radio facilities. Faster more frequent schedules, longer passenger lists, mounting mail and express loads, all are reflected in the expanding communication needs of the new services.

Bendix Radio engineers have anticipated these needs with the development of complete aircraft radio installations for the transport planes of tomorrow incorporating such features as centralized controls, high and low frequency transmissions and full remote operation.

A bulletin describing Bendix Aircraft Radio Equipment is available and will be sent to interested persons upon request. Address all inquiries to 9th & Keating Streets N. E. Washington, D. C.

Bendix Radio Corporation, U. S. A.

CABLE ADDRESS "BENDIXCORP" NEW YORK

TYPE TA-2D TRANSMITTER

Rated conservatively at 100 watts output on either CW, MCW or PHONE transmissions, the Bendix Type TA-2D Aircraft Radio Transmitter is designed to operate on any one of eight crystal-controlled frequencies in the 300 600 KC and 2,000 18,000 KC ranges. Complete electrical remote control facilities are included.

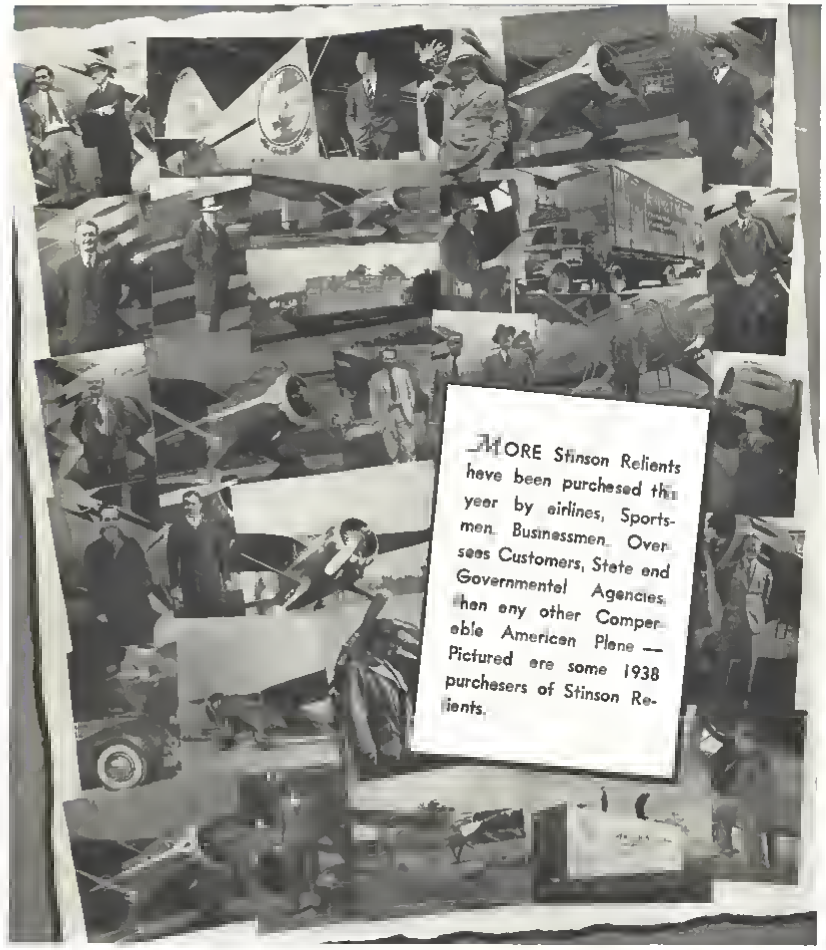
TYPE MT-36B ANTENNA TUNING UNIT

The Bendix Type MT 36B Antenna Tuning Unit permits matching the output of the Type TA 2D Transmitter to any standard aircraft antenna for efficient power transfer on frequencies between 300 and 600 KC. Remote electrical frequency selection operates simultaneously with the transmitter remote control.

TYPE RA-2A RECEIVER

Designed for fixed frequency operation, the Bendix Type RA 2A Aircraft Receiver permits rapid selection of any one of eight pre-selected, crystal-controlled channels between 2500 and 7000 KC. Dual audio output circuits with independent volume controls permit the pilot and co-pilot to make individual adjustments.

Again STINSON RELIANT LEADS IN POPULARITY



STINSON AIRCRAFT CORPORATION
DIVISION AVIATION MANUFACTURING CORPORATION
WAYNE (Detroit Suburb) MICHIGAN, U. S. A.

Published monthly price 35c a copy Subscription rates—United States Mexico and Central and South American Countries, $3.00 a year All other countries, $4.00 a year or 24 shillings Entered as second class matter September [illegible] at the Post Office Albany N Y under the Act of March 3 1879. Volume 8" Number 7

Up and Down the ON TEXACO!

CONTINENTAL AIR LINES, INC.

MUNICIPAL AIRPORT DENVER, COLORADO

April 29, 1938

The Texas Company,
135 East 42nd Street,
New York, N. Y.

Gentlemen:

I feel there are two excellent reasons why Continental offers a tough test for petroleum products.

First - we operate the fastest block-to-block schedules in the world - 187 miles per hour.

Second - we operate over the highest altitude route in the world with an average field altitude of our Denver-El Paso route of 5638 feet.

The fact that our Lockheed 12's are 100% Texaco serviced, is one of the main reasons for our exceptional engine performance, economy and stability. Engine overhaul costs are consistently far below average.

Sincerely,
Robert F. Six,
President.

RFS:g

The Lockheeds of Continental Air Lines are "up in the air," even when they are on the ground.

Flying not merely across the Continental Divide, but parallel to it, these ships take off from airports situated at 4,000 to 7,000 ft above sea-level

Operating at these mountain elevations is a real test of fuels and lubricants. Knowing this, Continental Air Lines chose TEXACO 100% ... both gasoline and engine oil.

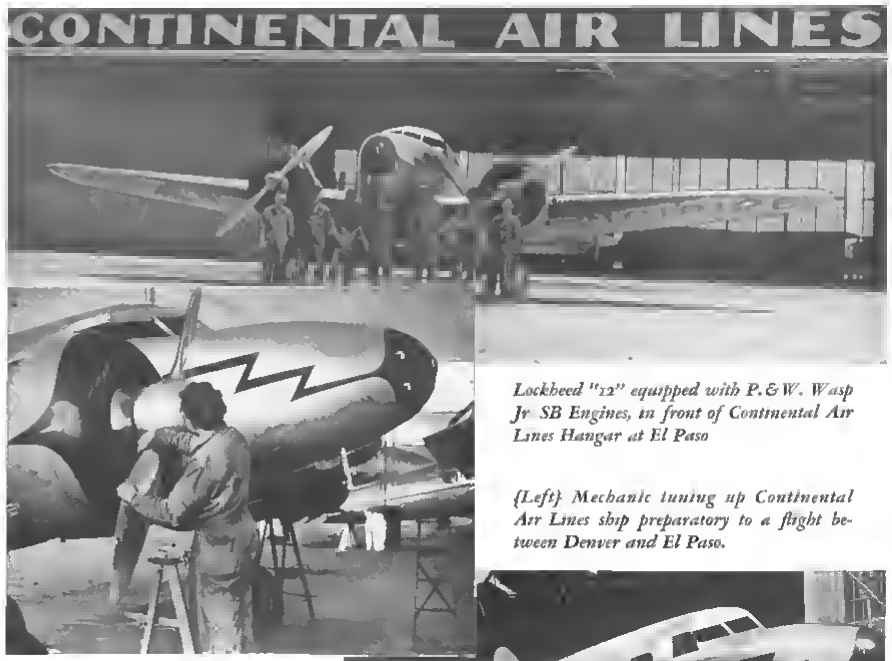
Trained aviation engineers are available for the selection and application of Texaco Aviation Products. Prompt deliveries assured from 2108 warehouse plants throughout the United States. The Texas Company, *Aviation Division*, 135 East 42nd St., New York City.

Texaco Asphalt builds resilient rugged economical surfaces for airport runways, hangar floors, and aprons, driveways and parking areas.

Continental Air Lines fly through skies that average 74% brilliant sunshine ... highest annual average of any route in the U. S., forming a connecting link between the Transcontinental routes of TWA, United and American Airlines.

TEXACO *Aviation*

CONTINENTAL DIVIDE...



Lockheed "12" equipped with P. & W. Wasp Jr. SB Engines, in front of Continental Air Lines Hangar at El Paso

(Left) Mechanic tuning up Continental Air Lines ship preparatory to a flight between Denver and El Paso.

FUELS & LUBRICANTS

THE
OLDEST AMERICAN
AERONAUTICAL MAGAZINE

AVIATION

Established 1515
McGraw Hill Publishing Company Inc.

Published monthly price 35c a copy. Subscription rates—United States, Canada, and Latin American republics, $6.00 a year. All other countries, $8.00 a year or 30 shillings. Entered as second class matter September 3, 1928, at the Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Cable address, McGrawhill, New York. Member of A.B.C. Copyright 1938 by McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York, N. Y. The following publications are combined with AVIATION: AERONAUTICAL ENGINEERING, AIR RAFT JOURNAL and THE AVIATION NEWS.

Mexican Air Force Eyan S-TM

Contents for Vol. 37, No. 7

JULY 1938

Flashes — 13
From the Skyways of the World

Side Slips *By Robert R. Osborn* — 17

Frontispiece — 18
Checking the Bearers at Bimini

Editorials — 19
A Law at Last, Red Letter Day

Giants of 1938 — 20
The Douglas DC 4 and Boeing Clipper are Test Flown

Aircraft Armament *By Horace J. Alter* — 22
First of Two Articles on Weapons for Aircraft

Compact Maintenance *By R. L. Anderson* — 24
How Chicago & Southern Solves the Problem

$20 and a Half-Paid-For Plane *By Al Knauff* — 26
Building Business on a Small Airport with a Small Investment

Hydromatic Propeller *By Frank W. Caldwell* — 28
Hamilton Standard's Feathering Propeller

Flying Equipment — 35
- Spencer Larsen Amphibian — 35
- Brewster XF2A-1 — 38
- Beech F17D — 39
- Allare Engine — 39

Aircraft Radio *By Don Fink* — 40
New Equipment for Communication and Navigation

Buyers Log Book — 44
A Review of New Equipment for the Industry

THE AVIATION NEWS — 51
- Congress Passes Commission Bills — 53
- Aviation in Washington — 54
- Aviation People — 58
- Logging the Lines — 60
- As Others Fly It — 64

Operators Corner — 68

Flashes

From the Skyways of the World

» THE WEEK of June 6th was a busy one on the West Coast what with test flights in the offing on both the Boeing 314 and the Douglas DC 4 Our West Coast editor had to do what he could to be in two or three places at once, places that were as much as 1200 miles apart What follows in this department this time is from his logbook Elsewhere in the issue will be found his description of the two big ships

» WE'RE AWFULLY SORRY we couldn't have had all of you with us the past ten days, during which we've developed a lovely tan around the tonsils while watching the races at Oakland, the Boeing Atlantic Clipper tests for five days on Puget Sound, and the Douglas DC-4 test hop at Santa Monica

» THING WE LIKED BEST at Seattle was the courtesy extended to us by the U S Coast Guard Three of Uncle Sam's snappy little patrol boats carted news men around all week, and not a one of us got dunked in Puget Sound But plenty of Puget Sound came up over the bow and wet us down on some of the fast runs we made trying to pace the Clipper One morning we missed the Coast Guard and had to wobble our way clear across Puget Sound in a rowboat pushed by a two hp outboard that stalled every few minutes, and almost stranded us right out in the middle of nowhere

» THAT DAY EDDIE ALLEN TAXIED THE CLIPPER so far north that we went ashore at a little shore town called Edmonds for lunch 'Twas Sunday and the only lunch stand in town was presided over by a lone lovely little lady who was SO worried about the Clipper and SO interested in aviation, when she learned we were from the Clipper expedition. She was only the proprietor's daughter but she did alright by us Then there was the noon time when Boeing's Harold Mansfield took the news men to the DeLuxe Hamburger for lunch between Clipper tests, and to speed the service he told the help we were the Clipper crew So all the patrons made a rush for autographs on napkins.

» BERGER ANDERSON, chief weights engineer for Boeing, is passing out the cigars—because of the weight of his baby The baby, Boeing's 314, came through her official weigh-in to show an actual weight that was within fifty pounds of the design figure and, Believe it or Not!, was fifty pounds under the design weight Anderson is bearing up under the congratulations with becoming modesty.

» ADD TO THE LIST of modern miracles the DC-4 first flight. It was announced that she would fly on June 7th, and promptly at 4:45 June 7th she flew Most dramatic first hop we've ever witnessed—partially because we stationed ourselves in the line of take off at the head of the runway, for picture purposes. Members of the first flight crew: Carl Cover, Douglas vice-president in charge of Sales, John Cable, Douglas chief test pilot, co-pilot, Al Reed, flight engineer, Jack Grant, chief mechanic, and Sam Beer, chief electrician

What's In This Issue

The month of June was filled with events of major importance for U. S. aviation. The biggest news out of Washington was the final passage of the consolidated Lea-McCarran bills, of which some details are given in the AVIATION NEWS on page 53. . . . Other big news concerned the test flying of the Giants of 1938 the Boeing 314 and the Douglas DC-4 Complete descriptions of these airplanes are given on pages 20 and 21. . . . What with wars and rumours of wars the problem of aircraft armament is of considerable interest these days. Mr. H. J. Alter has gathered together some interesting material on the subject. The first of two articles appears on page 22 of this issue. . . . The smaller airline people have maintenance problems peculiar to their type of operation. How Chicago & Southern keeps its ships in shape is told on page 24 . . . A success story of how two smart operators made money from a small initial investment at a small airport begins on page 26 . . . Full feathering propellers are in the limelight now The first description of the Hamilton Standard hydromatic appears in this issue on page 28. . . . Beyond the two big ships the Flying Equipment Department includes an interesting new amphibian the Spencer Larsen, the Brewster single-seat fighter; a Jacobs-powered Beechcraft; and a discussion of a new type aircraft engine designed by Heraclio Alfaro

» So many folks were interested in the DC-4 test that the Douglas laboratory phone system was thrown out of commission. The plant has a phone system equivalent to that of a town of ten thousand population, but according to A. M. Rochlen the calls piled up until the fuses blew. To cure the phone load they hired six extra operators, most of whom spent their time telling people when the DC-4 would fly.

» Crowds on the Clover Field airport became almost unmanageable. They lined every foot of the field boundary. It was probably the most publicly staged of all first flights to date. But then you can't hide a thirty three ton airplane away in a corner. Eddie Allen was able to taxi the Boeing Clipper way out in Puget Sound away from the madding crowds, and even pretty well away from the fleet of yachts and pleasure boats that hung on his flanks, before he put the 314 up on the step, but Carl Cover had to do his stuff with the DC-4 right in front of a highly critical audience. There were almost as many camera lenses trained on the scene as there were human optics. The Santa Monica police had loud speakers mounted on their cars to help direct the crowds and to head off potential stampedes.

» We thought the most dangerous part of the DC-4 tests were the high step ladders that the crew had to climb to get in the cabin and cockpit. Perhaps the cabin door is only ten feet above the ground, but it looked like twenty or thirty.

» The DC-4 took off with a gross weight of 53,000 lb., compared with her bare weight of 43,000 lb. Test equipment alone weighed 8,500 lb. What an airplane! It requires four and a half tons of instruments and gadgets just to find out what is happening aboard! But what was happening looked plenty good to us. After she was off Cover brought the DC-4 back over the field with her wheels tucked in and she was a pretty sight. We'd say truly majestic. She circled Santa Monica and Los Angeles several times, convoyed by a huge fleet of DC-3s, Boeing 247's, Army bombers, etc. Most of the convoy planes carried convoys of photographers recording the occasion for posterity. Then May Cover made a landing at Los Angeles Airport, where the ship will be based for tests. First time down he didn't touch the brakes and took off again immediately. Next landing he slapped on the brakes and stopped p.d.q., which means short in any language. Then he made a take-off in nine seconds. After several landings at Los Angeles Airport the crew wheeled up to the line, someone produced an extension ladder, and they all climbed safely down and went home to supper.

» An interesting point on the DC-4 which we somehow missed until after seeing her on the runway, is that her flaps are a combination of full trailing edge type on the wing panels, and split flaps across the center section. Looks like a logical set-up, and we suppose the wing trailing edge flaps can be dropped to assist take-off. Though the way she took off at Los Angeles Airport indicates that no one need worry too much about developing super airports for big planes yet awhile. It's our guess that the DC-4 could get in and out of many a cow-pasture and potato patch if occasion ever required.

» One of those things which "just can't happen"—a collision between an automobile and an airplane, resulted in a judgment of $25,000 for Ray Pignet, pilot, against Weldon Van Gundy, asserted driver of the automobile which collided with Pignet's plane on the runaway of Clover Field airport, Santa Monica, Jan. 19, 1937, just as Pignet was landing. An additional $2,350 was awarded to the Pacific Flying Service for damages to the plane caused by the automobile.

"Maguire's found one helluva good soaring thermal!"

Side Slips

By ROBERT OSBORN

» NEWS DISPATCHES tell us that Aspretto, the picturesque port in the island of Corsica is now being developed into a powerful seaplane base. If we have been keeping count correctly this means that there is now only one island in the Mediterranean which has not been fortified and made

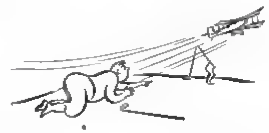
into some kind of a military base. However work is expected to start on that last island as soon as enough mud can be dredged up to bring it above water at high tide.

» EACH DAY'S NEWS brings further evidence that war preparations continue at top speed in all European nations, in spite of the published predictions of foreign affairs experts that there will be no war for years. We hope that this country will continue to build up its own defenses,—and we'd suggest for adoption as our national slogan the one made famous by Al Capone—"We don't want no trouble."

» "AIRPORT PROJECTS ACTED UPON—The following W P A. airport and airmarking projects were acted upon: Brewton, Ala.—Jurisdiction was waived on a supplemental project calling for $3,387 Federal funds for the construction of a golf course at the municipal airport."—*Air Commerce Bulletin*

There is a really useful W P A. project as there's nothing which seems to provide the boys with more good clean fun around an airport than a golf course. In the late 1920's a golf course was built adjacent to the old Curtiss Field, now Roosevelt Field, on Long Island. The course was in the direction of the prevailing wind and was at the end of the short runway, so unfortunately for the smooth backswing of the members most of the take-offs were right over their heads at an altitude of seven feet. Nearly all of the crack ups, of which there were many in those days, ended up on the course, generally messing up a putting green or a bit of shrubbery. Also the parachute instructor had a standing bet as to how many of his students he could land on the course during his Sunday exhibition of group jumping.

Finally one day a flying student busted up his just-purchased, $150, hundred-and-second hand "Jenny" spang in the middle of the course. The irate manager of the country club rushed over to the county seat and obtained a court order restraining anyone from removing said wrecked airplane until the damage was paid for. He waved this order under the noses of the Field officials causing much amusement, as he did not know that the disgusted student had walked



across the field, sold his helmet and goggles, and driven away in his car having decided that he wasn't cut out for flying after all.

» SPEAKING OF JENNIES reminds us that The Intrepid Aviator was in again the other day, and as he was finishing our third cigar, remarked that he read where the new Navy dirigible was going to have a safety system of bells to warn against undue stress in any part of the structure. He was wondering if something like that could have been the cause of the ringing in his ears he noticed frequently while flying his Jenny just before the Department of Commerce finally condemned it for keeps.

» ALSO, SPEAKING OF EXHIBITION PARACHUTE JUMPERS we have often overheard people in the crowds at air shows wondering what becomes of them if they survive the perils of their profession and decide to retire. We can report on one of them—the man who did the jumping at Curtiss Field around 1926-28. Week-days he was a mechanic at the airplane factory and on week-ends he made jumps at the field for whatever collection could be obtained from the crowd. He used an ancient bag-pack which was tied to the wing with any piece of rotten clothes line he could find lying around the hangar, and he would jump in any weather short of a hurricane. His friends used to advise a little more care and precaution but were never able to make any impression on him.

He wandered away from that section after a while and later we saw him working in an airplane plant in St. Louis. Then we lost track of him until we found him working as a mechanic at a small seaplane base in Miami. We asked him if he was still making his jumps and he answered, "I should say not! Don't even fly much any more, and I get scared pink whenever I think of the tricks I used to do."

AVIATION Photo

Flight control at Elmira

A LAW AT LAST

THE TUMULT and the shouting has died. The dust is beginning to settle again on Capitol Hill. And departing, the 75th Congress has left behind it at least one very definite footprint in the sands of time, the Civil Aeronautics Act of 1938.

Congress has done its job. It took some truly heroic work on the part of the industry to fan the sparks and keep the flame of interest alive in congressional minds that were swamped with wages-and-hours and reorganization problems (and were already thinking ahead toward November elections). Finally, however, the bills were passed, reconciled in conference, approved and sent to the White House for signature.

The next move is the President's. As we write, no announcement of appointments to the Authority has been forthcoming, although something may pop at any minute. We can only repeat the pious hope expressed so often before in these pages, that some consideration be given to the aeronautical competence of the men selected to serve on the CAA. We can only remind the administration again that here is no spot to pay off old political indebtedness, nor to curry new political favor. How well the White House recognizes the importance of aviation to America will be indicated by the calibre of the men appointed to the key positions in the new Authority.

Now, what are we, as an industry going to do about the new law? We asked for it,—now we've got it and we are going to have to live with it for some time to come.

We believe that it is a good law. It undoubtedly contains rough spots that will have to be smoothed out by interpretation as time goes on, but fundamentally it provides the most solid working platform for aviation that we have ever had. And no industry group can honestly say that its problems were overlooked in the drafting, or that unwelcome features were crammed down its gullet. Certainly everyone who had anything to say was given ample opportunity to sound off and let his ideas be heard. Few bills have been drafted and redrafted as many times in preparation to satisfy the wishes of minority interests. The industry actually wrote its own ticket.

Only one sensible course is open. The Civil Aeronautics Act has given aviation the most powerful tool we have ever had for sound and rapid progress on all fronts. The government has gone well over half way in the matter and might rightfully resent any claim from now on that it was standing in the way of progress. Definitely, the ball has been passed back to this aviation industry,—and on its own terms,—and it is up to us to carry it on a long steady march down the field. But if we fumble it, or make many off-side plays, Lord help us! Government may well be justified in snatching the ball away again and in imposing penalties that would be far from our liking.

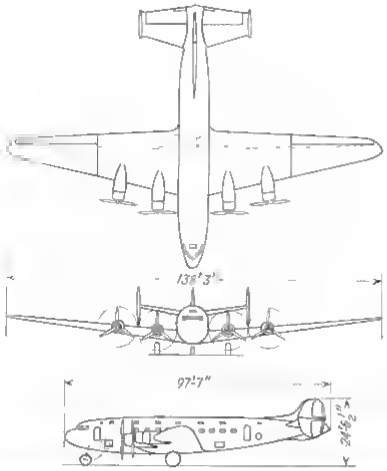
At the start we may not like this or that detail as it comes to be interpreted by the Commission. We may not like this or that member of the Commission. But it certainly makes good sense for every individual and company in the business to cooperate with the Authority to the fullest possible extent. Now that we have some assurance of stability, we can set to work to make definite plans for the future. The industry has an opportunity here that it has never had before. If we muff it this time we will have no one but ourselves to blame.

PROGRESS, OR SOMETHING!

BEYOND ALL QUESTION OF DOUBT, Tuesday, June 7th was a Red Letter Day in U S aviation annals. Within a few hours the two largest commercial aircraft yet built in America took to the air on maiden flights. Elsewhere in this issue will be found accounts of these outstanding events, and descriptions of the two machines.

We live in a fast moving age. We pause to toss a pair of orchids to Douglas and to Boeing for the success of the two ships but we can't pause for long. Practically on the heels of the news reels of the first take-offs come announcements of much bigger ships to come, of a Navy project for a $3,000,000 patrol boat, an Army bomber of 250 foot span, not to mention a Pan American specification (long since written) for a 200,000 pound commercial craft. The population may gape at DC 4s and Atlantic Clippers, but we must look upon them not as ultimates, but only as interesting and highly important steps toward the normal aircraft of the world airways of the not-too-distant future.

GIANTS OF 1938



Douglas DC-4

Behavior of tri-cycle gear on America's largest commercial land plane being watched with interest everywhere.

AVIATION

Vice-President Carl Cover (left) took-off the DC-4 for first time (below).

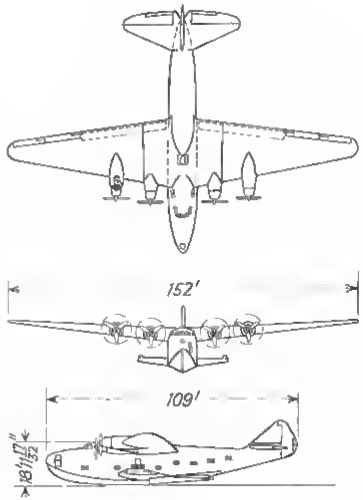
ABOUT TWO YEARS AGO, in an effort to evolve an ideal type transport airplane without costly unnecessary competition, five U S air lines put their heads together and wrote a specification. Now after many months of engineering, construction and testing, the result of that effort, the Douglas DC 4, is undergoing her shakedown flights. It is too early yet for complete performance figures, but it is safe to assume that they will come up to or exceed the specifications originally drawn up.

Not the first four engined plane by many years, not the largest plane in aviation history by many tons, the DC-4 may well prove to be the most significant commercial plane to date. As her smaller predecessors, the DC-1, DC-2, and DC-3 have quickened the pace and broadened the scope of world travel, so the DC-4 may well be expected to open new vistas for air travel everywhere. Faster, safer, more economical transportation is the aim of the multitude of engineers and craftsmen who have combined their talents in the design and construction of the DC-4. And because the great Douglas organization has been founded on and built on, a tradition of success, the eyes of the aviation world are turned, this month to Santa Monica. We all await with interest release of official performance figures following factory flight tests.

Of greater significance than the size and speed of the DC-4 are the new

(*Turn to page 30*)

AVIATION



Boeing 314

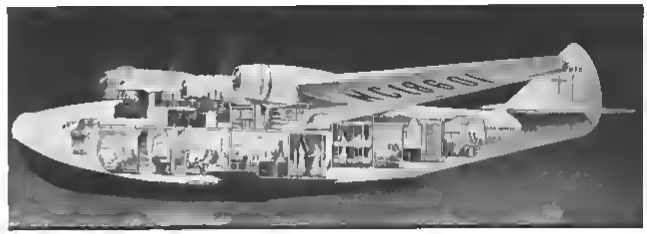
Largest American-built flying boat designed to carry 10,000 lb. payload for 2,400 miles at 150 m.p.h. Test flown in Puget Sound.

ALTHOUGH PAN AMERICAN AIRWAYS successfully pioneered both the Atlantic and the Pacific air routes with flying boats that seemed huge at the time of their introduction, it long since became apparent that they would have to move into a much larger class than the original Clippers to handle reasonable payloads over extremely long ranges. The new 41-ton Boeing described herein is another step in the direction of the really large ships of the not too distant future. It is an extremely interesting and important project as it pushes the boundaries of airplane size beyond anything heretofore known in America.

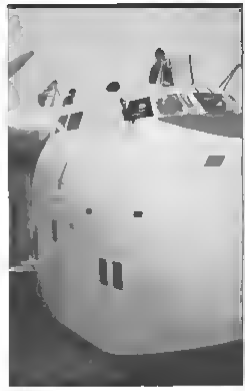
The 314 is an impressive airplane from every angle, large, well appointed, rugged. It is a business like airplane, not only for the steady way in which it rides the waves at rest, or while taxiing, but in the execution of the manifold mechanical and crew functions which surround and attend its operation.

In structure, the design goes back to the famous Monomail with its two-spar cantilever wing and monocoque fuselage. In aerodynamic design the 314 uses the same wing which has proved successful on the greatest

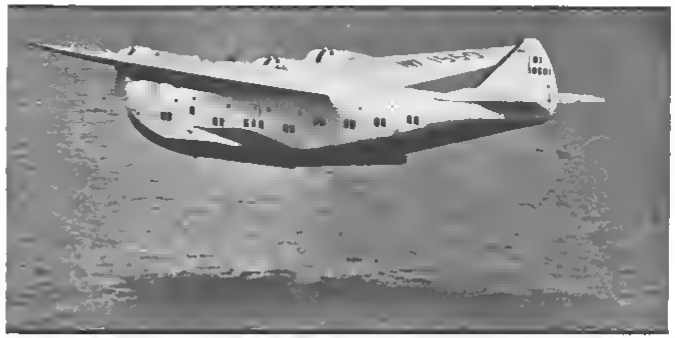
(*Turn to page 32*)



Big ship, little pilot. Edmund T. Allen (right) pilots clipper's first flight (below)



AVIATION



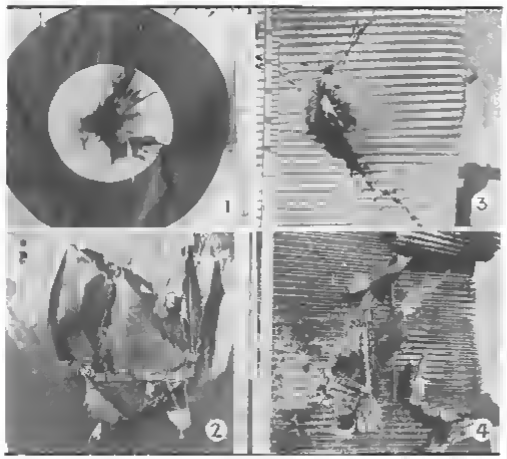
AIRCRAFT
ARMAMENT

The first of two articles dealing with offensive and defensive weapons for modern aircraft. This article deals with the guns themselves, the second with installations

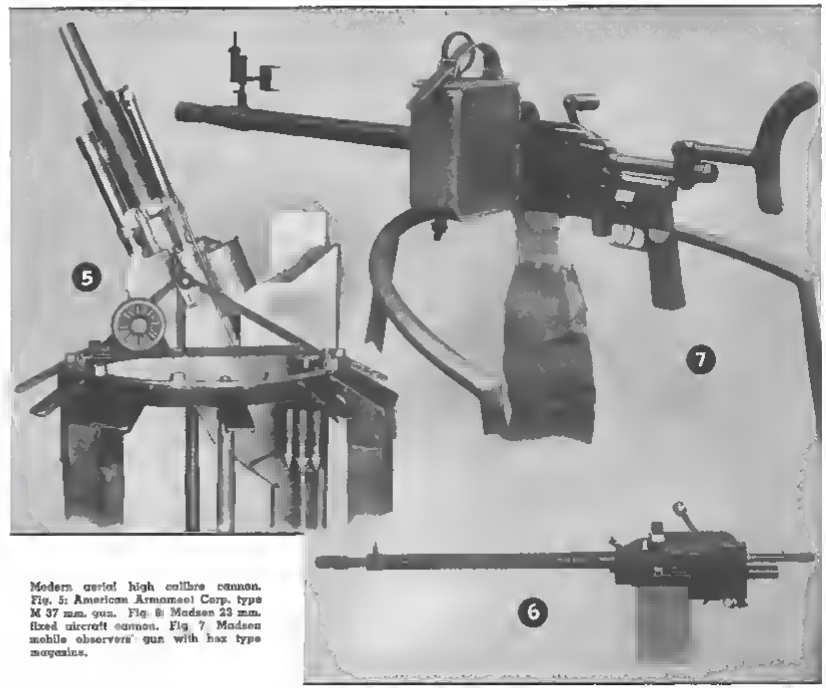
Part I

AIR ATTACK AND AIR DEFENSE have developed into a race in much the same manner as that between the armor plate manufacturer and the heavy gun manufacturer When the present situation is examined, the inadequate defensive armament of the new pursuit planes causes grave concern It has become generally realized abroad that fighters and pursuit planes are almost useless unless they are equipped with a heavy complement of armament, since the manner in which the airplane executes a defensive or offensive operation depends upon the character of the armament installation The high speeds of modern aircraft will limit an air encounter to but a few seconds duration and it is necessary to have weapons which can be effectively utilized every fraction of a second that the planes are in contact. The guns that count are those that can be brought into quick action with decisive damage to the enemy Therefore, the size and placement of the armament is the deciding factor and not the total number of guns that the airplane may carry

It follows, that the increasingly wide adoption of the cannon, or shell firing aerial gun, by European powers is a perfectly logical move since machine gun cannons of 25 mm and above fire explosive shells whose effect even on the wings of a metal plane are fairly conclusive (Fig 1 to 4) Comparison between the machine gun and the cannon brings out the following facts At close range 100 to 400 yds, the 30 calibre gun firing at a rate of 1200 rds a min has good effect but at longer ranges the trajectory of the .30 calibre bullet drops fairly rapidly For ranges up to 600 feet, the 50 calibre bullet has a flatter path but only has a rate of fire of 375 rds. per min It has been maintained that a single place fighter carrying 8 high speed machine guns can discharge a greater number of projectiles in a given period of time than a cannon While this is true, the destructive effect of the machine gun bullets is small compared with that of the cannon Modern metal airplanes are capable of being riddled with rifle bullets without being destroyed or even being excluded from the combat Moreover, the high speeds make accurate placement of fire even more difficult than ever before During the World War, a bomber gunner or pursuit pilot had time to aim his guns or airplane on his adversary and follow him in his sights during the period of attack At speeds of 280 or 325 m.p.h. it is quite impossible for the gunner to figure out the necessary corrections for windage etc. and aim his gun during the short period of time that the encounter takes place Other points out that when two airplanes flying at 310 m p h pass each other at close range, firing 400 rds per min, the bullets are spaced approximately 110 feet apart If the vulnerable length of the airplane is 23 feet, the bullets miss their mark by 1/40 of a second—a miss as good as a mile The necessity of



Effect of 23 mm. Madsen explosive shell on various types of aircraft construction. Fig 1: Point of entry fabric wing Fig 2: Point of exit, fabric wing Fig 3: Entry, metal wing Fig 4 Exit, metal wing (Courtesy Dansk Industrie Syndikat.)



Modern aerial high calibre cannon. Fig. 5: American Armament Corp. type M 37 mm. gun. Fig. 6: Madsen 23 mm. fixed aircraft cannon. Fig. 7. Madsen mobile observers' gun with box type magazine.

By Horace J. Alter

having an explosive shell which will have a destructive effect when placed in the vicinity of the plane, without scoring a direct hit is borne out by the above example

The airplane cannon was first used successfully during 1917–1918 when it was applied as a fixed installation to the motor, firing through a hollow propeller hub The efficiency of this arrangement at high speed is questionable. Since only one gun can be incorporated in such arrangement a sufficient concentration of fire cannot be procured If the bomber or attacked airplane is equipped with a similar gun, flexibly mounted, a barrage of fire (of explosive shells) can be layed by its gunner, through which the pursuing plane must advance The pursuing airplane is at a distinct disadvantage in a maneuver of this type. A number of radial engined, single seater fighters of European manufacture carry cannons in each wing which offers a good installation The new Polish P Z L., the Potez 63, Harriot 220 and Fokker Gr-I all mount groups of cannons So does Lawrence Bell's "Airacuda", of which 13 are on Air Corps order

In developing the cannon, it has been necessary to develop a small projectile equipped with a super-sensitive fuse that will act instantaneously when hitting an object such as wing fabric Shells have to explode after a flight of about 2 to 4 seconds in order to avoid casualties among friendly planes or ground troops Automatic destruction of the shell is obtained through use of, and usually with, a tracer container

Two types of automatic cannons incorporating the desirable features above are described herewith — the 37 mm cannon manufactured by the American Armament Corporation and the 20–23 mm. Madsen Cannon manufactured by the Dansk Industrie Syndikat. Other types such as the Oerlikon (see page 72). Vickers and Hotchkiss are available

The American Armament Corporation cannon 37 mm (1.457 inches) bore fires a high explosive shell of 5 kgs (1 1 lb) at a velocity of 1,250 f p s for the type "M" and 2,700 f p s for the type "F." It is manufactured in two types, specifications for which are given in an accompanying table through courtesy of the American Armament Corporation.

Specifications of AAC 37 mm. Aircraft Gun Type M

Calibre	37 mm. (1.457 in.)
Length in Calibres	20
Length in recoil	254 mm. (10 in.)

(*Turn to page 72*)

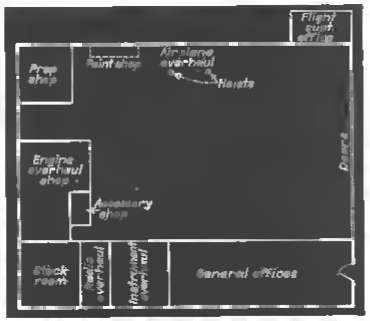
Chicago & Southern maintenance and operating headquarters are located on Lambert Field at Robertson, Mo

Compact MAINTENANCE

By R. L. Anderson

Superintendent of Maintenance

Operating a small airline poses economic questions that are not bothersome to the larger fry. The Superintendent of Maintenance of Chicago and Southern lays a few of his solutions out on the table.*



CHICAGO AND SOUTHERN AIR LINES operates over Air Mail Route No 8 between Chicago and New Orleans, an airline distance of 960 miles In the winter two round trips are operated daily During the summer months a third round trip is added The two round trip daily schedules provide for 10,000 miles per month, while the third round trip increases this mileage to 15600 Such short mileage routes provide problems that are extremely difficult. It is almost an impossibility to get most economical number of hours out of equipment per month, consequently operations costs cannot be reduced to a minimum and depreciation costs are high since the useful life of the equipment cannot be obtained before it becomes obsolete

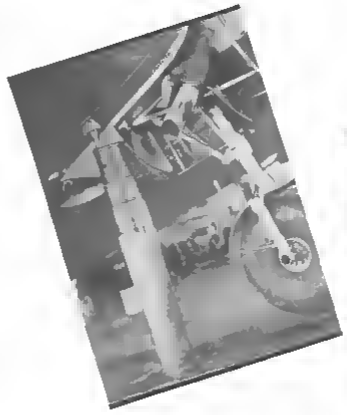
We operate with five Lockheed Electras Model 10-B Four of these ships are continually in use and the fifth in overhaul Many times during the summer operation it is found necessary to have all five ships in operation but during the winter period it is possible to completely overhaul all five airplanes and put them back in perfect condition so that only a minimum amount of attention is necessary during the summer

Our main overhaul and maintenance base is located at St. Louis and it is here that all overhaul regular engine, airplane, instrument and radio service is taken care of Routine flight checks are run at New Orleans and Chicago, where all flights originate

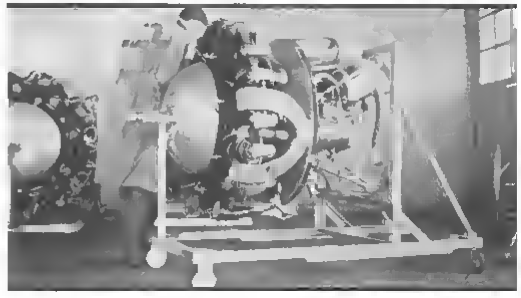
Our St. Louis overhaul shop measures 80 by 100 feet. This does not give us too much room and we have had to tax our ingenuity to the fullest extent to conserve and use this space to the greatest advantage. The piece of equipment that we have made up and installed which has saved the most space in our airplane shop is a pair of hydraulic jacks which we use in service and overhaul work on our Electras It is unnecessary to use service stands and ladders, which take up just as much floor space when not in use as they do when they are being used to service an airplane The jacks are the standard hydraulic lifts used in grease racks for servicing automobiles They are set in foundations flush with the floor, and spaced the center distance between the standard jack pads on the under side of the wing of a Lockheed Electra. Each one of the lifts has a detachable top which is removed when the jack is not being used The tops have a ball bearing turntable with an extension adapter anchored to it, 3" off center from the turntable, and rounded at the top to fit into the standard Lockheed jack pads fastened on the under side of the wing. It is not necessary to have the airplane lined up perfectly with relation to the center of the lift columns, because the adaptor on the turntable top can be rotated to line up with the jack pad socket Because the jack pads of the Electra are located behind the center of gravity it is necessary to ballast or tie down the tail when the ship is on the jacks

When an airplane is brought in for engine change or service it is lined up over the two jacks, the jack pads are attached to the wing the lifts are raised, and the adapters are lined up to enter the jack pad sockets Before lifting the weight of the airplane, the tail is tied down The airplane is then lifted with the hydraulic jacks until the wheels clear the floor The landing gear is retracted and the airplane lowered until the engine is at

(*Turn to page 75*)



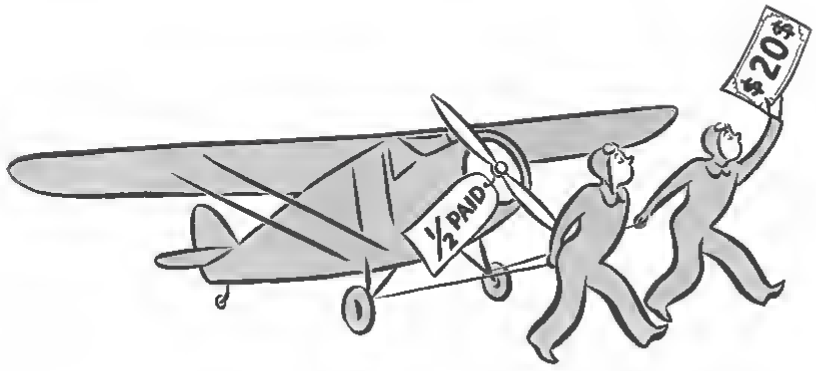
(Above and Left) Most useful tool in Chicago & Southern shops is a pair of hydraulic jacks. Note eccentric mounting of jack head to register easily with pads. Mechanics may work on engines at floor level.



This convenient portable work stand permits working on engines and accessories, either in the horizontal or vertical positions

Everything ahead of the fire wall is run-in on a unit on this portable test stand.

* From a paper read before the January 1938 meeting of the Maintenance Committee of the Air Transport Association of America at Dallas, Tex



$20 and a Half-Paid-for PLANE

was the beginning of a thriving operation on a small airport. Hundreds of small fields can be developed in the same way.

By Al Knouff

Business Manager, Swiftair
Athens, Ohio

PLEASE DON'T stop me if you've heard this one.

With one of our students—a good prospect for an airplane—I flew to the "airport" of a city about twice the size of ours. It is a D of C emergency field and they tell me the boundary lights look very pretty at night, but when we arrived it was more deserted than a haunted house. There weren't even any spooks. It took us 30 minutes to walk to a telephone and get a taxi out to us. We had to let the plane stand unguarded in a rising wind while we attended to business in town. The day was chilly—and so was our prospect's enthusiasm for flying as a practical time saver before we left.

Sure, it's an old story—but why should it be. There is an immediate living and a bright future for some live-wire young pilot on that field.

The idea that an airport can be profitable without some sort of subsidy is comparatively new—and some will say crazy. But Bob Swift, my partner, and I have reason to believe that unwise injections of government money have made aviation a drug addict—unable to support itself without artificial stimulation. The cure won't be easy, but it can be done.

One thing is certain. Until the small airport is put on a sound basis—with or without government help—the growth of private flying will be limited. Only private enterprise can carry out some of the activity necessary to a successful airport. You, too, will be convinced if you pay us a visit in Athens.

No matter what time of day or night you arrive, there will be someone at the airport to greet you. Before you reach the hangar, you will be asked whether you want fuel or just to park, and will be directed accordingly.

Are you hungry? Do you want to go to town for any reason? The airport car—a good one—is at your service. There is a lunchroom about a block away. Do you want to call some friend, or get weather information? You are welcome to use our telephone. There is no charge for this service (except long distance calls of course). Perhaps we lose money on the transaction, but we hope you go away with the desire to come back and that you will tell friends Athens is a good place to stop.

The profit is shown in the phenomenal increase in number of visitors in the two years we have been operating. Before we came, Athens had had about a dozen visiting planes. In 1936 we had 57, and last year there were more than 109 ships—carrying about 200 pilots and passengers!

These brought a nice bit of business to local hotels and restaurants, and most of them bought something from us, but even if our margin on their purchases did not cover the cost of the service, there is another more obscure result which we believe will bring our real profits. You see, we sell airplanes, storage, and service.

SOME of these visitors are going to talk about the service and convenience offered here, and their talk is going to reach the ears of some other operator, or some young pilot who will put the information to his own use. The result will be another field, somewhere, operated on the same basis as ours—and another—and another.

Each of these 'anothers" will increase the convenience of private flying and make it easier for us to sell airplanes. Besides the commission, most of these airplanes we sell will pay us storage and buy gasoline, oil, and labor. Likewise, the smart young pilots and operators who adopt these methods will reap similar benefits.

When we started out to find a place to operate, our meager capital had dwindled to a $20 bill and an airplane which was little more than half paid for. There was only one plane in Athens when we arrived. Three months after we settled we got socked with the worst blizzard in 50 years. It goes without saying that there were times when we wondered where our next meal was coming from—and some of them didn't come—but we make it a point to fly at least once a day regardless of weather.

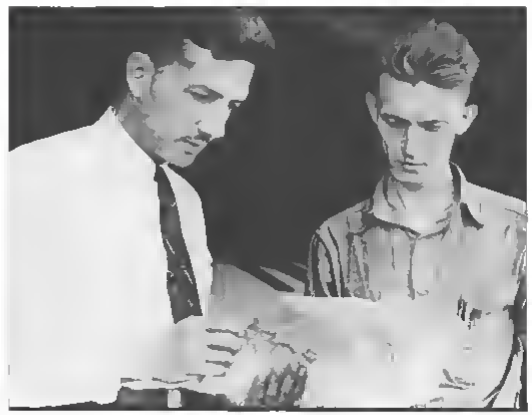
When that winter passed, we had made an impression on the town that is worth money to us now. They didn't see how we stuck it out, but the fact that we did gave them confidence in us *and in aviation*. A few months ago we needed $1,000 in a hurry—and we got it in less than four hours. Incidentally, we paid it back.

Our hangar is now full of airplanes which give us a regular income to meet rent, light, heat, and telephone bills. We are now planning a larger hangar to meet future needs.

Last winter we suffered two other socks which in the past would have put an operator out of business. After an unblemished record of 1,400 hours, Bob got lost due to ground fog late one afternoon and hit a tree when forced to land. Two weeks later, our record of more than 5,000 hours flown by pilots Bob had trained without any kind of accident, was shattered when one of them—who had recently received his private license—cracked up, killing himself and injuring his passenger. Yet even the wives of our students accepted these misfortunes as though they were automobile accidents.

Most of our students are ordinary business men who see the value of aviation as a means of personal transportation. They expect to own their own planes eventually. In fact, for the past year we have made no effort to sell instruction except as a build up for prospective purchasers—or as a service to our aircraft purchasers. These customers base their appreciation of flying on the way our field is operated, and we need more fields like this to maintain the impression we have created.

As soon as we have more hangar space, several of these men will buy planes. Although we hope to sell them ourselves, we welcome any competitor who wants to demonstrate his ship, and will give him every cooperation—even suggesting prospects. You see we will get the storage and service, which in the long run will be more than the commission.



The two partners, the author and Bob Swift

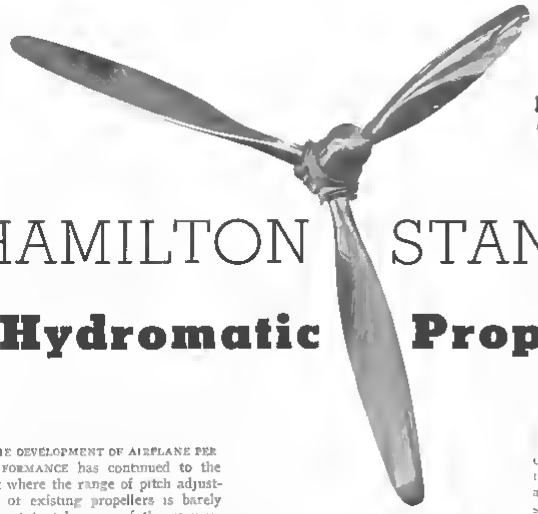
IT IS TRUE we don't have any pretty red and green boundary lights. Maybe some day we can afford them—if the manufacturers of such equipment realize that there is a market other than the government, and adjust prices accordingly. Meanwhile, if you expect to arrive at night, phone us in advance—or if you are caught in the dark, circle town until we light our floodlight. It is really a spotlight which we turn on the windsock (due north and upward about 60 degrees) until the visitor has spotted the field, then we turn it around toward the opposite corner of the field, in which position it floods the field with sufficient light to land. Since there are no fences or other obstructions at either end of our two-way field, the night landing is reasonably safe even with this limited equipment.

Usually we flash the green signal of our traffic light on the visitor—signalling the letter "A"—so that he can positively identify the field.

In order to be successful, we believe airport operation must be a full time business. The operator must be on the job 24 hours a day so as not to miss any business, and must be alert to every source of income. Here are a few of the lines we have found worthwhile:

Storage, sale of airplanes, sale of gas and oil, maintenance and repair, instruction, airline tickets (this isn't profitable in itself, but it leads to an occasional charter), charter flying, photography, model kits and supplies, ground school, aviation texts and magazine subscriptions.

We have not solved all our problems, but we have something to show for our efforts. We haven't all the facilities we would like to have, but we will have them as soon as we really need them and can pay for them. We aren't getting rich, but we believe that when there is an airport like ours in every county seat, and several in every large city, all of us in aviation will make a living.



By Frank W. Caldwell
Engineering Manager Hamilton Standard Propellers East Hartford, Conn

HAMILTON STANDARD
Hydromatic Propeller

THE DEVELOPMENT OF AIRPLANE PERFORMANCE has continued to the point where the range of pitch adjustment of existing propellers is barely sufficient to take care of the requirements. Whereas the first controllables used only 4 or 5 degrees of pitch angle change, current types are using up to 20 degrees and projected types will need still more.

In addition to the requirement for additional pitch range, there has been a need in certain types of airplanes for stopping the rotation of engines which may have failed in such a way as to render their continued rotation dangerous. If the pitch angles of the propeller are rapidly increased to around 87 deg. at the three quarter radius point, the rotation of the engine is stopped almost instantly and the resistance of the idle propeller is reduced to a minimum. The difference in ceiling of a twin-engine airplane with one propeller feathered compared to the case of one propeller braked may be as much as 2000 feet under certain conditions.

To meet these requirements for greater pitch angle rang during normal operation and for full feathering in emergencies the engineering staff of Hamilton Standard has been hard at work for the past three years on the development of the Hydromatic propeller, the design being carried out under the direction of Erle Martin, chief engineer. To date, the Hydromatic propellers have had more than 500 hours of ground testing and more than 3000 hours of flight testing including successful tests for Department of Commerce Approved Type Certificates and for official Army and Navy approval.

Throughout the design, the seriousness and importance of the safety problem has been fully recognized. One of the most important advances in this connection has been the application of a method of measuring vibration stresses in the blades. This method has been under development in the Hamilton Standard laboratory for the past six years and is considered as offering a marked contribution to propeller safety.

The pitch control mechanism of the Hydromatic propeller is again of the simple, rugged hydraulic type although differing somewhat in actual application from the earlier constant speed propellers. One of the reasons for this is the additional safety problem introduced as a result of the feather procedure. Propellers in the feathered position will not carry out the normal propulsive function and it would obviously be dangerous if they could be feathered inadvertently or through improper functioning of the apparatus. Consequently, it is necessary to provide some means of restricting the pitch range during normal operation so that the blades cannot be feathered except by a deliberate action on the part of the pilot.

This problem was solved by Hamilton Standard by taking advantage of the fact that the centrifugal force acting on the blades tends to cause them to go into low pitch. In the Hydromatic design, engine oil which has been boosted to higher pressure by the constant speed governor pump is used to overcome this centrifugal twisting moment when it is necessary to increase the pitch. This oil pressure acts on a large piston and the motion of the piston is transformed into rotary motion by means of a series of cam rollers acting on coaxial helical cams of opposite pitch slope. For the normal pitch range the cam follows a steep helical angle so that the piston enjoys a high mechanical advantage. When the pitch reaches the maximum operating value, the slope of the cam becomes flatter so that the mechanical advantage of the piston is insufficient to overcome the centrifugal twisting moments of the blades when the normal operating pressures are used. Thus, a maximum pitch limit is provided for the normal flight conditions. If a considerably increased oil pressure is supplied from some other source under the control of the pilot the piston will overcome the blade twisting moment and the pitch will increase until the feathered setting is reached.

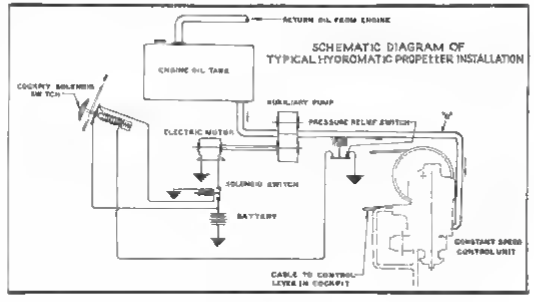


Fig. 2

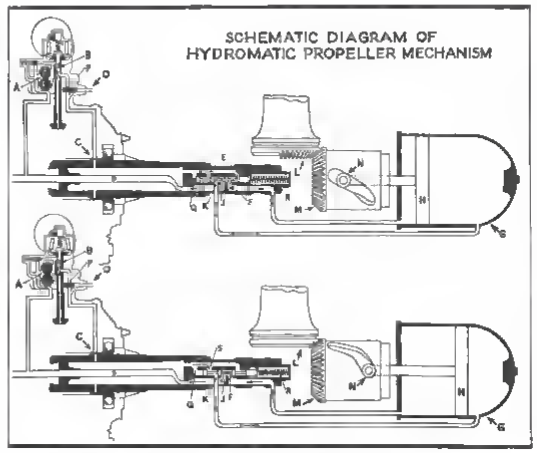
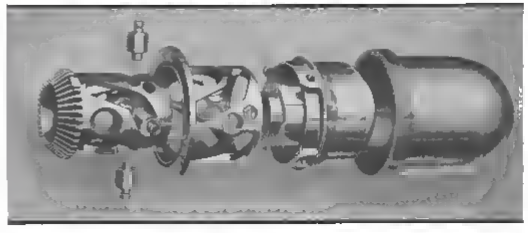
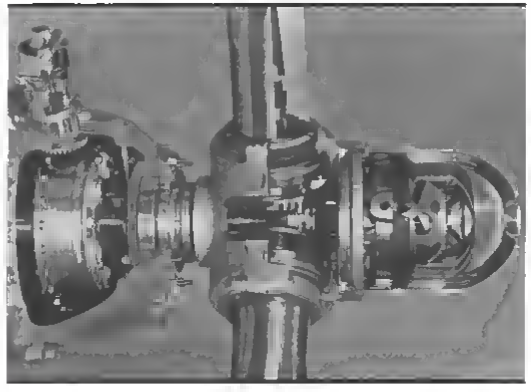


Fig. 1





The adjustment toward low pitch is also accomplished by oil pressure, supplementing and augmenting the centrifugal force on the blades. In this case, the oil is also engine oil but under normal pressure. This oil pressure is at all times acting on the opposite face of the propeller piston, and provides a "resilient member" opposing any tendency for a change to higher pitch. Whenever the constant speed governor valve relieves the higher oil pressure on the other face of the piston, this resilient pressure, together with the centrifugal force on the blades, moves the blades toward low pitch.

When it is desired to feather the blades, an auxiliary pressure supply system is put into operation. A typical example of such a system is shown in Fig. 2. The pump is mounted between the engine oil tank and the constant speed control, and sends oil under pressure through line 0, shown in Fig. 1, to the cut-out valve built into the base of the constant speed control. The auxiliary system shown in Fig. 2 allows the pump to draw its oil from the engine oil tank, alternative installations have employed either a separate oil tank or used the hydraulic system of the airplane in place of engine oil and the special pump.

The pump very rapidly builds up pressure in line 0 disconnecting the governor from the propeller and at the same time opening this pump line to the propeller by compressing the spring P in the cut-off valve. This feathering oil pressure is transmitted to the rotating propeller shaft past the oil transfer rings C, see top view of Fig. 1, through port E of the distributor valve assembly, out port F to the inboard side of the piston H. The piston moves out under this pressure, and forces the engine oil, on its out-

(*Turn to page 76*)

Douglas DC-4

Story continued from page 20

features for operating efficiency and maintenance economy which have been incorporated throughout the design Most obvious of these is the tri-cycle landing gear This is expected to yield greater comfort for passengers during take-off and landing, which should help increase passenger traffic The tri-cycle gear should also permit faster taxiing, cross wind landings, and easier field handling, which should reduce cost of operation

A hundred and one new maintenance ideas have been incorporated throughout the plane Aerodynamically and structurally the DC-4 presents few radical features, but for the shop crews there are new points of interest behind every hand-hole and cowling section The engines are more accessible and more quickly demountable Instead of sending fueling crew men scrambling up over the wing the fuel tanks are filled from the bottom by means of new type valves Throughout the airplane the wiring, plumbing, and control rigging is easier to reach than heretofore. There is a control tunnel in the fuselage beneath the passenger cabin which is so big that not only one man, but several, can work in it simultaneously

The engineers have thought of everything and apparently have provided for everything Take the telephone system, for example Not only is complete inter communication among crew members available in flight, but, by plugging in a ground connection at terminals, passengers may talk to any telephone in the world And the crew chief has a phone all his own which he uses to communicate with the pilot up in the cockpit to speed servicing

Structurally the DC-4 follows conventional skin-stressed design with semi-monocoque fuselage and multicellular wing But one important refinement is the use of flush-type riveting on all external surfaces.

To provide for future developments in high altitude flight the plane has been designed so that all production models can be pressurized to carry an altitude pressure equivalent to 12,000 ft while flying at 20,000 ft

Adequate control of the big plane is assured through use of a hydraulic "booster" system which multiplies the pilot's strength in handling rudders, elevators, and ailerons The same hydraulic system provides safety locks to prevent the control surfaces from being damaged by wind gusts while the plane is at rest or taxiing Sufficient power to operate the electrical accessories is assured through use of two independent 110 volt power generator units to provide current for the lights phones, instruments radio, cooking, electrical razor, hair curler, etc

Traffic promotion features include arrangements for handling baggage within the main cabin so that it is accessible in flight. Berths are arranged for sleeper service so that a seat is adjacent to each for use of the person who wants to read for a while before going to bed For the business man, a Dictaphone is available for use en route. Hot and cold running water are on tap in both lavatories A private drawing room with separate dressing room is available as de luxe accommodation All cabin windows are double glass, with an air space between, to minimize engine noise and eliminate frosting The galley is provided with a refrigerator, hot food compartment, electric toaster and percolator, etc The several baggage compartments even include a refrigerated room for perishable commodities

Throughout the DC-4, from the 14 ft. Hamilton-Standard Hydromatic propellers and 1400 hp twin Hornet Pratt & Whitney engines, to the deicer equipment on each of the three tails, there are developments which represent the combined effort of many specialists However great the contribution that has been made by the engineers of the five airlines who developed the specifications for this plane, and of the Douglas engineers who designed it to these specifications the contribution to the advancement of aviation that has been made by allied and cooperating technicians deserves high praise New tires had to be developed, new brake problems solved, new shock struts designed, new instruments, new materials, new nuts, bolts, screws and rivets

And yet there is nothing in the DC-4 that is not tested and proved

Nose is of plywood to prevent radio loop shielding

Note "blister" under the tail for emergency protection

Final engine adjustment before first flight.

From the start of the selection of materials and parts, engineers have been testing samples and assemblies A complete wing section was built and tested to destruction The story of these tests is a fascinating bit of aviation history of itself (See AVIATION June 1938) Suffice it to say here that when the DC-4 takes to the air it will be undergoing a test less rigorous than many which have been made during the period of its building Douglas engineers report that more than 100 000 man hours have been spent conducting tests Wind tunnel tests alone, under the direction of Dr Clark B. Millikan, cost $25 000 Drop tests of the main landing gear wheel were repeated fifty times with an impact force of 120 000 pounds The nosewheel and attachment gear were dropped twenty-five times with an impact force of 54 000 pounds Tanks were subjected to vibration tests of 125 hours at 2,000 cycles per minute More than 160 other major tests were made by Douglas engineers alone not taking into account the thousands of tests made by accessory and equipment manufacturers

No true conception of the size of the DC-4 is gained by quoting the wing span of 138 ft., or the gross weight of 65,000 lbs, but when one learns that there are 1,300,000 rivets used in the construction of the plane, and that 5,835 feet of control cable are used to direct its flight 113 flight and engine instruments aid the crew, 21 000 ft. of electrical wiring, 27,000 ft of extruded section in the structure, etc one begins to get a picture of the magnitude of the project

When the DC-4 has met all performance requirements of the airline contracts under which it has been developed to the satisfaction of Douglas engineers, it will be turned over to the airlines for a period of testing under service conditions For several months the plane will be flown by United, American, TWA, Eastern, and Pan American While no official announcement has been made it is reported that the Douglas Company is already at work on a lot of five DC-4s It is to be assumed that any such work would be of a preliminary nature as some changes are to be anticipated in the production model of the DC-4, based on flight tests As we contemplate the time when the DC-4 will ply from Coast to Coast with a large part of our domestic air travel loads, and will be seen on foreign airlines throughout the world, we cannot, in all modesty, conceive of an early end of the dominance of world air routes by American equipment,

Characteristics of the DC-4 as released by the Douglas Company are as follows

Wing span	138 ft 3 in
Length overall	97 ft 7 in
Height overall	24 ft. 6¼ in
Dihedral	7 degrees
Aspect ratio	8.87
Max. wing chord	25 ft 2 in
Wing area	2156 sq ft
Main wheel size	65 in
Nose wheel size	44 in
Main fuel tanks	1650 gal
Auxiliary tanks	400 gal.
Oil capacity	120 gal.
Crew	5
Passengers	42 (dayplane)
"	32 (sleeper)
Cargo and baggage space	563 cu ft.
Cargo capacity	6 500 lbs
Gross weight	65 000 lbs
Empty weight	45 000 lbs (sleeper)
Empty weight	43 750 lbs (dayplane)
Useful load	20,000 lbs. (sleeper)
Useful load	21,250 lbs (dayplane)
Engines	4 Pratt & Whitney R-2180
" rated power	1150 h.p each at 2350 r p m
" maximum power	1400 h p each at 2500 r p.m. geared 2 to 1
Wing loading	30.15 lb./sq ft.
Power loading	11 61 (take-off)
Performance on four engines	
(The plane can maintain flight on any two engines at 8 000 ft altitude.)	
Max speed	240 m p h at 7 000 ft altitude
Cruising speed	200 m p.h. at 65 per cent power at 10 000 ft altitude
Landing speed	69 m p h at 65,000 lbs gross weight
Service ceiling	22,900 ft
Climb at sea level on take-off power	1175 ft./mm.
Take-off distance at sea level	1180 ft.

Boeing 314

Story continued from page 21

bomber, the XB-15 This wing is notable for its high taper ratio (four to one from root to tip) and for its symmetrical airfoil section varying from the NACA 0018 at the root to the NACA 0010 at the tip This airfoil provides constant center of pressure, minimum profile drag with flaps up and high maximum lift with flaps down.

Six of the 314s are now building for Pan American The first, now undergoing flight tests, will go into regular service late this summer, and other planes will follow at intervals of about two months The structure of No 2 is now virtually complete and early in July she will be wheeled out into the open for attachment of wing panels, fitting of power plants, and final adjustment

Gross weight of the 314 is 82 500 lbs Wing span is 152 ft, and wing area 2867 sq ft Maximum passenger capacity in normal operation as a dayplane is 74 and as nightplane 40, with crew of eight in each case Range with 40 passengers, in still air, 4,000 miles

The 314 is the largest plane of any kind ever built in America It is equipped with the most powerful radial engines yet produced—four 1500 horsepower two-row Wright Cyclones, and is propelled by the newest Hamilton Standard Hydromatic (full-feathering) three bladed propellers of 14 ft. diameter It is the first passenger airliner with engines accessible in flight.

In general design the 314 is a high wing monoplane flying boat with a single hull, hydro stabilizers for stability on the water, and full cantilever surfaces throughout, including the sponsons The wing and tail structures are internally braced, highly tapered. Structurally the plane is all metal except that the trailing edge of the wing, and the moveable control surfaces are fabric covered The hull is of the semi monocoque type with truss framing being confined to lateral bulkheads except for the longitudinal keel and bottom stringers The wings are of two spar design using heavy truss construction and employing stressed skin covering to the rear spar to take torsion and drag loads Dural tube and sheet is the major structural material although stainless steel fittings are freely used throughout the hull and steel tubing is employed in the engine mounts and wing center section Of special interest are the four monocoque engine nacelles, which permit complete freedom of movement by the crew in approaching engine accessories, etc Also of interest is the careful use of rugged tube sections in all trussing These tubes in some cases are of approximately rectangular external form yet round internally, combining the structural advantages of the round tube with the assembly features of the flat sided tube for greater ease of riveting or bolting The external alclad sheet material with which the fore part of the wing is covered is first formed into a single integral piece by spot welding standard size sheets together then anodized for extra corrosion protection and to improve paintability of the metal, and is applied in one piece to the wing by riveting Major production economies are effected by this method and the finished wing is smoother, as all riveting at the sheet joints is eliminated

Fuel tanks are built integrally with the sponsons, each sponson carrying 1500 gallons of fuel in two compartments A single 600 gallon fuel tank is located back of each inboard engine in the center section

All controls are operated by cables Following the Boeing system developed for large aircraft, the 314 is operated by means of manually operable tabs on all surfaces For normal flying, stick forces amount to only 50 lb If extreme control surface movement is necessary in emergencies, the tab control mechanism is arranged to "bottom" against stops and the control force is transferred directly to the control surfaces In all flying done with such controls to date, however there has been no case in which the tabs failed to handle the control surface A second tab is used to balance each control surface Static balance of rudder and elevators is provided by lead weights swinging within the tail of the hull on lever arms. Locks are provided at each control surface to prevent damage by wind while the plane is at rest The locking pins are provided with safety springs which force them out to free the locked surface if the lock control cable should break. Ailerons are of Frise type, with 17½ degrees down and 22½ degrees up travel Operation is by cable acting on a semi irreversible worm gear which serves as protection against aileron flutter Flaps are of split trailing edge type, electrically operated to 60 degrees

The power installation is designed for minimum change time This is largely accomplished through careful manifolding of all hydraulic lines at the point of engine attachment to the nacelle structure Due to the roominess of the nacelle it is possible for mechanics to make and break engine connections very quickly As a result of the large size of the plane, together with the open truss structure of the wing, all control cables, electric conduits, and hydraulic lines are open for easy inspection and servicing at almost all points throughout the plane The same is true of the structure of the plane proper

Interior arrangements of the hull are well planned Entrance may be made over either seawing through large rectangular doors into the main lounge in the approximate fore-and-aft center of the hull. This room is about eight feet high, twelve feet wide and fifteen feet long Forward of this lounge are two large passenger compartments separated by the galley, men's room and spiral stairway to the upper deck Forward of this, and separated from the main deck by a water tight bulkhead, is the bow compartment with seamen's quarters, anchor gear, etc. Aft of the main lounge are five passenger compartments, the rearmost of which is a private cabin suite. The ladies room is also aft of the lounge. Above the main deck is the flight deck, reached by the spiral stairway The forward end of the flight deck is occupied by the control room, measuring 12½ by 21 ft. and having the bridge, or pilot's cockpit at the front, with the navigator on the port side and the radio operator on the starboard side. Back of these two stations is the master's desk and chair, with a second chair for conferences with crew members The rearmost station on the starboard side is occupied by the flight engineer With a flying personnel of six and two stewards the normal working crew is eight.

Aft of the control room is the main cargo room, which extends out into each wing stub. Aft of the cargo room are the crew's quarters with luggage holds still further aft An observation turret for navigation is located in the top deck over the cargo hold and may be raised to serve as a loading hatch The seaman's compartment forward is reached by a stairway from the control room, and it has a bow hatch for handling mooring lines and anchor gear, and a side hatch for crew entrance and exit. Doorways lead from the control room into each wing where catwalks provide access to the engine compartments

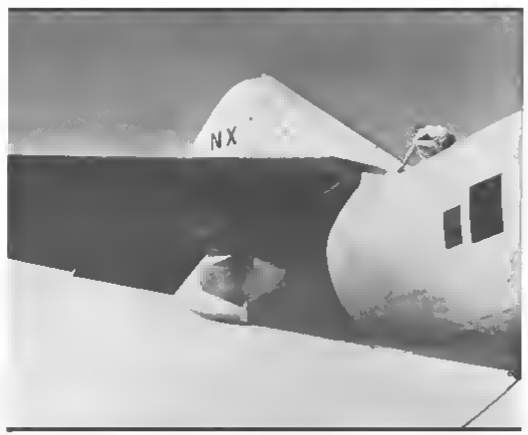
The pilots have a simplified control board, practically all engine instruments and controls being handled by the flight engineer The instrument installation is a story in itself Generous use has been made of the new auto syn type instruments with dual indication. Thus 13 indications are taken from each engine for a total of 52 engine readings from only 19 instruments Including other instruments a total of 62 readings are taken from 26 instruments on the flight engineers board.

Indicative of the complete equipment of the plane is the annunciator system, with 54 stations and twelve lights

Test flights are in charge of Edmund T Allen, veteran test pilot and consulting engineer With Allen on the first, and succeeding flights were Earl Ferguson, co-pilot, Mike Pavone and Bud Benton, flight engineers, W C Lundquist and Frank J Wiegand, Wright Aeronautical Corporation Wellwood Beall Boeing project engineer, also accompanied this crew on much of the preliminary testing.

Specifications on the 314 as supplied by the manufacturer follow:

Engines	Four Wright twin-Cyclones
Propellers	Hamilton-Standard Hydromatic, 14 ft. diameter
Wing span	152 ft.
Length	109 ft.
Over-all height	28½ ft.
Hull beam	12½ ft.
Draft	48 in.
Wing area	2867 sq ft (not including sponsons)
Incidence	4½ deg
Dihedral	4½ deg
Wing chord—	
root	29 ft 1 in
tip	7 ft 4 in
Aspect ratio	8.05 to 1
Weights	
Bare	41 680 lb
Empty	48,727 lb. (as 74 passenger dayplane)
Gross	82 500 lb
Wing loading	28.8 lbs /sq ft
Power loading	13.75 lbs./h p
Top speed	200 m.p.h.
Cruising speed	150 m p h @ 10,000 ft. altitude @ 50% power
Range	2400 m with 10,000 lbs payload against 35 m.p.h. head wind with 40 minutes reserve fuel
Stalling speed	69 m.p.h
Take off	60 sec, full load
Ceiling	24,000 ft (absolute)



The tail looks small until you put a man near it

It's a long walk along the clipper wing span

Platforms open from sides of nacelles

The Birdmen's Perch

What-Happens-When-A-Bird-Flies-Into-The-Propellor Dept There seems to be two sides to this question. One faction says it's good-bye to the prop and probably to the motor, too. The other claims it's just tough on the bird. To settle the argument, we'll take a vote. Shoot us a letter or a postcard with your opinion. *Quick*, like *a flash!* We'll try to print the result next month.

MAJOR AL WILLIAMS alias "Tattered Wing-Tips" Mgr. Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

WHOPPER CLUB BULLETIN

Our Whopper Club is a mighty exclusive organization. Only 12 new members a year. Each one gets a Diplome especially printed with an illustration of his tall story. See sample.

Can't you just see the new-found admiration and respect in your friends' eyes at the sight of one of these on your wall? Better send in your weirdest yarn about Gulf Aviation Gas right away.

PUZZLERS—ATTENTION

Back last April we said something about inserting a really hard puzzle. Since then time letters have come in by the squadron daring us to do our worst. Now this is not the hardest puzzle we could make up but it is more difficult than the others.

In the triangle below, how many ways may GULFPRIDE OIL be spelled moving always at right angles? (The letters must be in their correct sequence.) A few of the ways are indicated on the triangle, to give you a start.

GULFPRIDEOIL
ULFPRIDEOIL
LFPRIDEOIL
FPRIDEOIL
PRIDEOIL
RIDEOIL
IDEOIL
DEOIL
EOIL
OIL
IL
L

GULFPRIDE OIL may be spelled ... ways

(Mail your solutions to T. W. T., to be checked.)

LIKE SAND IN SPINACH

You know how it is with spinach. It takes more than one washing to rid yonng America's favorite fruit of tooth-grinding grit and sand.

Same way with oil. If you're out to make the world's finest oil for planes, one refining process simply is not enough. That's why, in addition to conventional methods, Gulf uses the exclusive Alchlor process in refining Gulfpride. This *extra* refining removes as much as 20% *more* motor gumming waste and sludge.

THIS MONTH'S WHOPPER

Dear Major

I ain't sayin' you done it a-purpose but you're no account Gulf Aviation Gas is ruinin' my business.

Yestiddy a flyin' feller sets his airy plane down right in front of my dude ranch ... out of gas. So I sends Pete, the hoss wrangler, to get some from town. While we're waitin' I'm cussin' out the prairie dogs fer diggin' burrows all over creation. And the flyin' feller says he's heard a little gas poured down the holes kinda discourages 'em.

So when Pete came back with a drum of Gulf Aviation Gas and 3 brand-new dudes I told him to try out the idee.

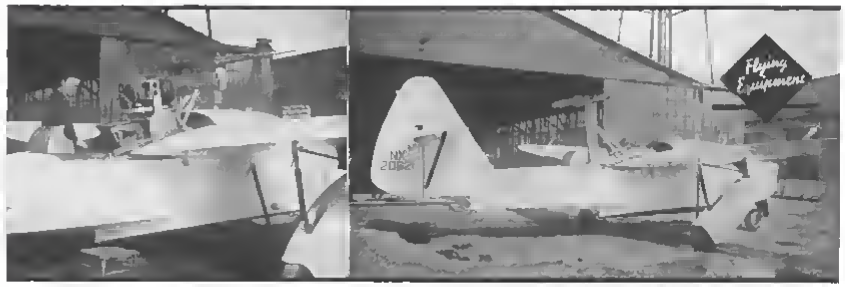
While he was doin' it I took the dudes out ridin'. We're comin' home when I seen a big bald eagle in the sky. So I tells the dudes that eagle is eight feet across and how he can carry off a sheep and may be a calf. They was mighty impressed.

We was comin' up to the ranch house when we seen a prairie dog sittin' outside his burrow. I says that's a prairie dog and there's thousands around. Just then the eagle musta seen him, too, cause he came down with a rush right at the little prairie dog. But instead of divin' for his hole that blamed critter just squared off and jumped up to meet the eagle!

Whamo! Old Baldy let out a screech like a catamount! For ten minutes I couldn't see nothin' but eagle feathers and an occasional bit o' hide along with 'em. Purty soon the dust settled and there was that deuged prairie dog sittin' up on top of the dead eagle twenty times bigger'n he was!

That was enough for my dudes! They took the next train East sayin' that any place ground hogs could whup eagles was too tough for *them*. The way I feel, Major, is that I on nights at least warn folks what effects that doggone Gulf Aviation Gas o' yourn is liable to have.

Pinto Bill Calihan



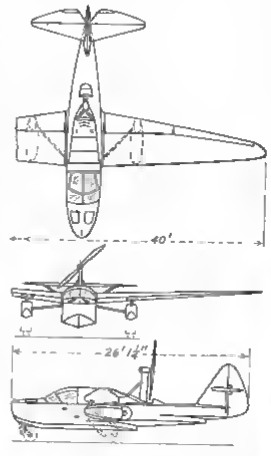
Spencer-Larsen AMPHIBIAN

Two place amphibian SL-12C has many original features

A REMOTELY DRIVEN PUSHER PROPELLER, a tricycle landing gear, combined float and wheel, and plywood construction are the distinguishing features of the SL-12C Amphibian offered by Spencer-Larsen of Farmingdale, N. Y. This interesting design is the result of a long period of research and development by P. H. Spencer, formerly of Amphibians Inc., and V. A. Larsen who has been with Fokker, Standard Aviation and Sikorsky. Test flights are now underway but performance figures are not yet available.

Most unusual feature is the power plant with its Menasco C-4 engine mounted within the hull and driving the pusher propeller through a gear transmission designed by the Kirkham Engineering & Manufacturing Co. A flexible spline drive connects motor to transmission eliminating all crankshaft loads except the driving torque. A flywheel with automotive starting ring is used with a conventional automobile starter. Engine and transmission are mounted as a complete unit which can be tilted forward and upward about 90 deg. for servicing. This can be accomplished in a few seconds as there is nothing to disconnect.

Main wheels of the tricycle landing gear are mounted in the after end of each wing float and retract with the floats. 8.00x5 tires and tubes are used with dual hydraulic brakes developed by Air Associates. Nose wheel is fully retractable and a small vee shaped door closes the opening for the wheel. Negative caster prevents crossing of the wheel on the ground. All retraction is hydraulic.



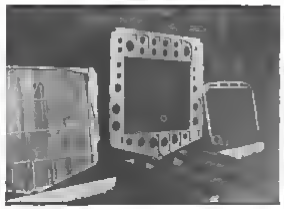
Wood construction is used wherever possible with hull, wing, and tail covering of phenolic bonded plywood protected internally by Bakelite varnish and externally by synthetic enamel. A full cantilever wing of single spar construction is used. Floats are also of wood construction.

Side by side seating is provided with duel wheel control in the cabin which is reached through two large hatches. Ample baggage space is provided behind the seats.

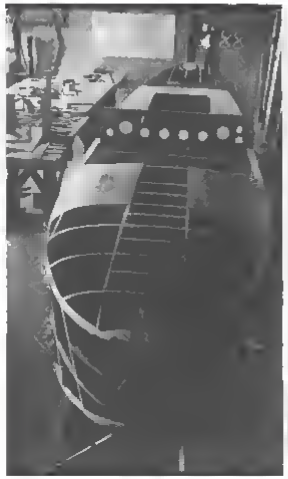
Specifications furnished by the manufacturer are as follows:

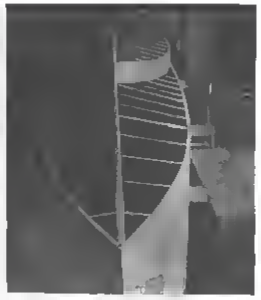
Dimensions	
Wing Span	40 ft.
Overall Length	26 ft. 1¼ in.
Max. Height	8 ft. 10 in.
Mean Aerodynamic Chord	56.3 in.
Dihedral	3° 30'
Incidence	4° 0'

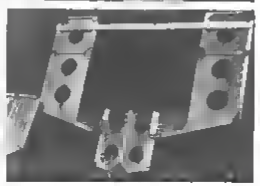
Landing wheels are built into floats.



Plywood hull frames of the SL-12C







Left. The bow end of the hull showing wooden structure and plywood covering.

Above: The hull bottom showing general construction and planing step

Below: One of the plywood bulkheads.

Taper Ratio	4:1
Tail Span	12 ft 6 in
Beam of Hull	45 in
Forebody Length	14 ft 0 in.
Afterbody Length	7 ft. 6 in
Dead Rise	..15°
Wheel Thread	11 ft. 6 in.
Wheel Base	9 ft. 3 in

Areas

Wing incl Aileron & Flap	164 sq.ft
Flap (2)	26.50 sq ft.
Aileron (2)	13.46 sq ft
Fin	9.70 sq.ft
Rudder	9.55 sq ft.
Total Vertical Tail Surfaces	19.25 sq.ft.
Stabilizer (2)	15.00 sq.ft.
Elevator (2)	11.65 sq ft.
Tab (2)	.85 sq ft.
Total Horizontal Tail Surfaces	27.50 sq ft

Weights

Gross Weight	2,200 lb
Useful Load	600 lb
Weight Empty	1,600 lb
Baggage	75 lb
Fuel Capacity	30 Gal
Oil Capacity	3 Gal

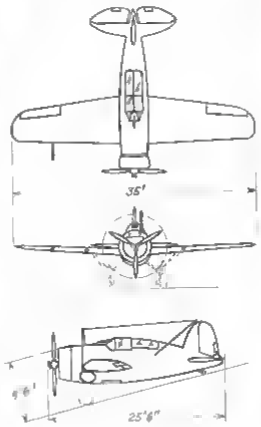
Brewster XF2A1 Single Seater Navy Fighter

Brewster XF2A-1

Navy Orders 54 Single Seater Fighters

PRODUCTION HAS BEEN STARTED by the Brewster Aeronautical Corporation on the XF2A-1 Single Seater Fighter, an order for 54 having been placed by the Navy at a total cost of $1,910,395. This ship is the second experimental airplane of all-metal monocoque construction built by Brewster for the Navy.

The XF2A-1 is equipped with hydraulically operated flaps and retractable landing gear. Like the earlier Navy ship it is powered by a Wright Cyclone engine. Cowling is quickly removable for ease of maintenance. Because of Navy restrictions, performance figures have not yet been released by the manufacturer.



Crankless Engine

Unconventional type designed by Heraclio Alfaro, and built in cooperation with the Indian Motorcycle Company, shows promise in M.I.T. tests

THE ENGINE TESTED at the Massachusetts Institute of Technology in the presence of John H Geisse of the Department of Commerce of the United States on May 16th, 1938, was a four cylinder, crankless, two stroke cycle, double opposed piston, fuel injection spark ignition, liquid cooled aircraft engine. It has a bore of 2⅛ inches and a double stroke of 3⅛ inches Its displacement is 157 cubic inches and its output is 115 horsepower at 2,000 R.P.M

The engine has its cylinders parallel to the shaft and can be built on an eight cylinder execution by grouping the cylinders closer together The weight of this engine dry is 240 pounds The cylinders however, are of cast iron and can be built in a lighter form in future designs.

Previous tests with a single cylinder engine of the same design indicated that the speed of this engine can reach 2900 R P M with a corresponding increase in horsepower.

Just as in the case of radial engine designs, the lightest weight of this type of engine is reached when a greater number of cylinders is employed In the light of the designs made, an eight cylinder engine of the same design can be built within 300 pounds weight and if such an engine is rated at 2400 R P M it is believed that its output would be 280 horsepower, resulting in the specific weight of slightly over one pound per horsepower.

The diameter of this engine excluding small protruding pipes and spark plug tips is 15½ inches Its dynamic balance is theoretically perfect, resulting in very smooth operation. While this first engine built is liquid-cooled, designs have been prepared of air-cooled execution in a very practical and attractive manner It is believed, however, that the liquid-cooled engine, in spite of the addition of a radiator will be much more attractive. For instance for the contemplated eight cylinder engine discussed above the weight of the radiator required will be approximately sixty pounds, which would bring its total specific weight to 1 28 pounds per horsepower

This design lends itself very well to larger power plants and designs have been prepared for power plants up to 2,000 horsepower at 1,075 R P M The calculated weight of such power plants is substantially under one pound per horsepower The size of this engine is substantially smaller than that of in line V engines of modern design and one-half its horsepower.

Tests of [illegible] consumption have been made also and readings as low as 435 pounds per brake horsepower hour have been obtained, without serious attempt to lower them further for the time being This is due to the fact that the compactness of the compression chamber and lack of hot valves allows a much higher compression ratio than is conventional This engine operates satisfactorily with 72 octane number fuel and a compression ratio of 9½ to 1 The maximum cylinder pressures go as far as 900 pounds per square inch No signs of detonation have been observed under these conditions The brake mean effective pressure obtained has been as high as 145 pounds per square inch and since it is done on a two stroke cycle operation it is equivalent to 290 pounds

(Turn to page 73)

D17 Beechcraft

New Model Powered With 300 hp. Jacobs Engine

LYING IN THE INTERMEDIATE POWER AND WEIGHT CLASSIFICATION between the E17B (285 hp) and the D17 (450 hp) models is the new F17D Beechcraft recently announced Power plant is the Jacobs L-6, seven cylinder engine rated 330 hp for take-off and 300 hp at 3700 ft Gross weight is 3,550 lb and useful load, 1,395 lb

Equipment includes either the Curtiss-Reed fixed pitch metal or the Hamilton-Standard controllable pitch propeller Constant speed equipment also can be supplied Standard gasoline tank capacity is 77 gallons but additional capacity up to 124 gallons can be supplied.

Fuel consumption is 17 gal per hour at 210 hp An allowance of 3½ gal is deducted for warm-up and climb to cruising altitude and a reserve of 45 min fuel (at 210 hp.) is available at all ranges specified Reserve supply increases range 132 miles Range and payload for various fuel capacities.

Fuel gallons	Range, miles	Payload, pounds
45	303	917
65	510	797
77	635	725
101	884	554
124	1,120	385

Performance as furnished by the manufacturer is as follows:

Cruising speed (fixed pitch propeller)	177 m.p.h.
Cruising speed (controllable propeller)	182 m.p.h.
Landing speed, sea level	46 m p h.
Rate of Climb, sea level	1 300 ft. per min.
Service ceiling (fixed pitch propeller)	18,000 ft.
Service ceiling (controllable propeller)	20,000 ft.

Aircraft Radio

New Equipment for Communication and Navigation by Don Fink

Appointment

Hanson joins staff of Radio Navigational Instrument Corp.

ANNOUNCEMENT HAS BEEN MADE of the appointment of Malcolm P Hanson, formerly in charge of technical work at the Radio Test Section of the Naval Research Laboratory, as vice-president in charge of engineering and production of the Radio Navigational Instrument Corp of New York Mr Hanson is widely known for his long career in the Naval radio service He accompanied Admiral Byrd to the Antarctic in 1928, where he was in charge of communications and radio measurements

Malcolm P. Hanson, new vice president of Radio Navigational Instrument Corp

Crystal-controlled Set

Learadio markets a new receiver

AS WE GO TO PRESS Bill Lear of Learadio, Roosevelt Field announces a new receiver, Model R3AB designed for use in the bands from 200 to 400 kc, 670 to 1750 kc. and 2900 to 6500 kc. Like the Lear radio compass, the receiver is divided in two sections, one containing the antenna, oscillator and mixer circuits the other the i-f. second detector and audio amplifier circuits By thus separating the tuning functions from the amplification and detection functions, a considerable saving in size and weight is obtained

Power is obtained from a 230 volt 100 ma dynamotor The total battery drain, at 12 volts, is 2.9 amps a low enough value so that the entire receiver may be operated in emergency from a dry battery supply for a total of at least five hours.

Crystal control of the beat oscillator frequency is available on any frequency throughout the tuning range of the receiver although the degree of resetability is such that crystal control is an advantage principally on the higher frequencies The crystal receptacle is mounted directly on the front panel The total weight of the entire unit is 10 pounds, 8 ounces Reception of cw signals is available on a model containing a beat oscillator

New Lear Crystal-controlled Receiver

Metcalf—M.I.T.

Progress reported on new blind-landing system

FOR MANY MONTHS it has been "off the-record" information that Irving Metcalf of the Bureau of Air Commerce and the staff of M.I.T. have been developing jointly a new system of instrument landing which differs markedly from all previous systems Now it appears that the work is nearing completion and a report is pending

The system is based on the fact that if the pilot can see three fixed points on an airport, he can make a landing, regardless of the visibility of other points In the Metcalf M.I.T. system, a transmitter is set up on the airport, and the location of the transmitter is revealed in the plane by one of three spots on the fluorescent screen of a cathode-ray tube Two other spots on the screens are obtained electrically from a Sperry artificial horizon As the plane flies in for a landing its relation in space with respect to the transmitter continually changes It is the function of the instrument landing system to follow the change in the apparent position of the transmitter and to present it to the pilot in such a way that he "sees" the location of the transmitter on the airport surface in relation to the horizon By employing a very narrow radio beam, it is possible to follow a flat glide path, an improvement over the curved paths produced in other systems

The original plan was to use infra-red (invisible light) rays as the transmitting medium from transmitter to plane This method is still being investigated but a more immediately practical solution seems to be the use of the extremely short [illegible] waves (less than one-half inch wavelength) and to employ a transmitting technique announced recently by Professor W L Barrow of M I T This technique permits the establishment of an extremely narrow beam of waves, by projecting them from a horn-shaped antenna Prominent in the development program in addition to Mr Metcalf and Prof Barrow have been Prof C S Draper of the Aeronautical Department of M I T., and Prof E L Bowles, Director of the Round Hill Station

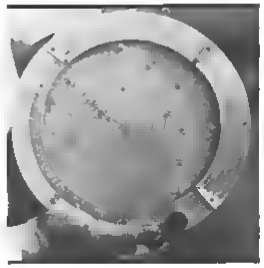
Announcement

Air-Track has new position finder on the market

A MECHANICAL POSITION FINDER, intended for use in connection with radio compass direction finders, has been announced by the Air-Track Manufacturing Corp of Washington, D C The finder is based on the design of Horace Stark, Penn Central Airlines pilot. As shown in the illustration, it consists of a circular holder in which is inserted a map on which are marked the locations of radio range stations Each map covers an area about 520 miles in diameter, so that all the principal airways of the country can be covered on 16 maps The accuracy of the map markings is assured since they are reproduced photographically from standard flying maps

The outer rim of the holder consists of three separate rings The two inner rings are marked with the points of the compass Within each of the rings is held a disc on which are marked parallel lines The discs are rotated by means of knobs geared to teeth on the edges of the discs The discs are transparent so the intersections of the parallel lines are clearly visible Over the uppermost disc is placed the map also transparent.

In operation the map is lined up with respect to the compass course then being flown using the indication of the magnetic or gyro compass Then using the radio compass separate bearings are taken on two radio beacon stations located within the area covered by the map Using the knobs one disc containing parallel lines is rotated until it is lined up with the bearing of the station heard, using the pointer at the center of the system of lines The other disc is similarly lined up with the other station Then the intersection of the two lines passing through the station locations, or the nearest interpolated lines, gives the position of the plane at the time the bearings are taken The device eliminates the need of any calculations, and is arranged so that it can be operated with one hand if necessary



Air-Track position finder eliminates all calculations in radio-compass flying

For flying over off airways terrain, a special transparent disc is supplied to which the required station locations can be transferred in pencil from existing maps This disc may be erased and used over again an indefinite number of times The accuracy of the position finder depends only on the accuracy of the maps and of the bearings from the radio direction finder Under ordinary conditions positions with two to five miles of the actual position may be obtained. It is important that the bearings on the two stations be made as quickly as possible so that they correspond to one point of the map For this reason a rotatable loop installation is desirable for use in connection with the position finder

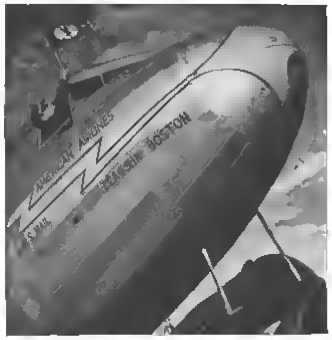
This tiny receiver has been designed and built by J. T. Lee Coast Guard Chief Radioman It covers the band from 200 to 400 kc. uses three tubes. Its small size and weight permit unconventional installations, such as that shown above

Demonstration

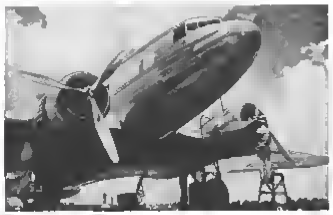
Simon Radioguide seen in flight test at Floyd Bennett

YOUR EDITOR was the guest of Mr Simon and Mr. Reed of Radio Navigational Instrument Corp on June 3, when he was given a very convincing demonstration of the Simon Radioguide, a cross-loop direction finder described recently in these columns The equipment was that installed in Major Max Fleischmann's Lockhead Electra, flown by Harry Ashe In a flight from Floyd Bennett out over station WEAF, and then over to Newark, the instrument showed conclusively its ability to distinguish both direction and sense, as well as approximate distance, with a minimum of attention from the pilot

"AMERICAN" HAS FLOWN DEPENDABLE GOODRICH



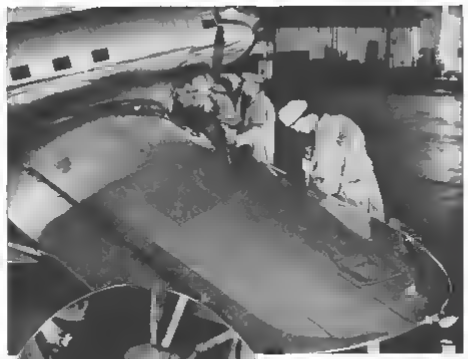
NEW YORK TO LOS ANGELES OVERNIGHT! American operates these giant new Douglas Cingalin Skysleepers on overnight coast to coast service. This great fleet along with luxurious Flagship Club Planes for day flights are *Goodrich-equipped for safety*



BREATHING SPELL — for the plane but not for mechanics. At the end of every trip American Airlines mechanics check and double-check motors planes runs, every part of these 12 ton giants. Safety is the first consideration 24 hours a day!

READY TO STEP OUT An American Airlines Flagship pauses before departure. And of course a take-off and landing on Goodrich Airplane Silvertowns will mark the start and completion of its safe journey

Safety Dominates Every American Airlines' Operation



INSYALLING THE GOODRICH WING DE ICER When weather signals flash ice warnings, these Goodrich "DE-ICERS" are ready to go into immediate action. Automatic inflation and deflation of longitudinal tubes inside the DE ICER loosens and lifts the ice so that wind can sweep the wing edge clear

CHECKING GOODRICH AIRPLANE SILVERTOWNS BEFORE A FLIGHT On American planes these huge low pressure Silvertowns encounter every type of landing surface from the hot sands of Texas to snow and sleet in New York

NO "PICK-UP" FOR ICE Propellers of American Airlines planes, too are kept free of ice by the Goodrich development shown at the right. This special sponge and slinger ring assembly constantly bathes the blades with a solution that defies formation of ice during winter and high altitude flying.

250 MILLION MILES WITH AVIATION EQUIPMENT!

AMERICAN AIRLINES, INC. PROTECTS BIG FLEET OF LUXURY "FLAGSHIPS" EXCLUSIVELY WITH GOODRICH TIRES AND DE-ICERS

● American Airlines' far flung system is one of the world's busiest. All day and all night its 12 ton giants sweep across 6,700 miles of airways—roll up over 50,000 miles of flying every 24 hours! A huge task that requires not only a smooth running organization in the air and on the ground but equipment that "stands up."

Ever since its pioneer days 'American' has found that Goodrich Low Pressure Tires stand the pace. It is the big reason why today American Airlines planes take off and land on these safer, smoother-landing tires. And, thanks to the protection of the Goodrich DE ICER, 'American' planes take winter and high altitude flying all in their stride.

Remember, over 40 Goodrich Aviation Products are used by the leading pilots, plane makers and air lines—a wide range of rubber products that can be engineered to meet the specific requirements of your planes, regardless of whether they carry one passenger or fifty. Write Dept. 660, Aeronautical Division of The B. F. Goodrich Co., Akron, Ohio, for complete information about Goodrich Aviation Products. Ask about the new Goodrich E. T.* Brakes—the greatest step forward in safer, smoother, quicker braking for all types of planes.

*Expander Tube

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes—Including Tires—Tail Wheels—Abrasion Shoes—DE ICERS—Matting—Rubber Hose—Grommets—Shock Absorber Cord—A Complete Line of Rubber Aeronautical Accessories.

Buyers' Log Book

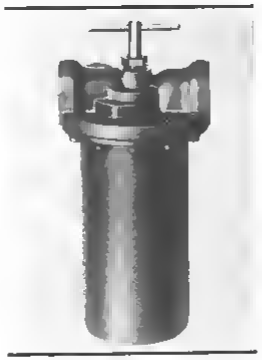
What's New in Accessories, Materials, Supplies, and Equipment

Hydraulic Filters

Cuno makes new application for landing gear and flap systems

FILTERS FOR HYDRAULIC FLAP and landing gear operating systems of both the direct acting or accumulator types are now offered by the Cuno Engineering Corp. These filters are of the disc type which has been made by Cuno for the machining tool industry for many years.

Disc type Auto Klean filters are applied in a variety of ways. They may be placed in the suction lines to the pressure pump, the discharge of the pump, in the control circuit of an accumulator system, or on the return lines. A number of factors determine the choice of filter location. Of primary importance is accessibility. The filter must be so located that the handle may be turned by the pilot or engineer officer, while the plane is in flight. If this is not done an automatic means of doing this (such as the Cuno Hydraulic Motor Head) must be provided. Filters on the suction side of hydraulic pressure pumps can be light weight since they do not need heavy housings but they must be designed with care as the suction of such pumps must not be loaded to the point where cavitation can occur. The filter element of a pressure side filter may safely be made smaller but the weight so saved may be lost due to the necessity of a high pressure housing. Control circuit installations are not ordinarily recommended because large flow rates may call for a large filter and the pump circuit is not protected. Return line installations may have light weight, low pressure housings but they do not afford the protection at the point where it is needed. It is impossible to get a general rule as to which location is best, each location must be considered individually on its merits all other factors being considered.—AVIATION *July 1938*



Type G Filter for Aircraft Hydraulic Systems

Free for Pilots

Is the Kollsman Altitude Temperature Computer

THE KOLLSMAN INSTRUMENT COMPANY (80-08 45th Avenue, Elmhurst N. Y.) offers free to any airline pilot or executive one of their new Altitude Computers. This device is a simple card and rubber band scale arrangement that gives true altitude corresponding to the indicated altitude for all air temperatures.

The purpose of this ingenious instrument is to emphasize the difference between true and indicated altitude for various temperature conditions which may be as much as 20 per cent. This correction must be applied to all altimeters regardless of the temperature errors of the instrument.—AVIATION *July 1938*

Kenilworth Beaching Gear

15 Ton Beaching Gear

Made by Kenilworth to Launch Boeing Clippers

WHEN THE NEW BOEING MODEL 314 first of six built for Pan-American Airways, was launched in the Duwamish waterway recently, it rolled down an inclined track and into the water mounted on the newest and biggest beaching gear unit yet developed. Twelve of these beaching gears are being built for Boeing and Pan Amer-

(*Turn to page 47*)

(*Continued from page 44*)

can by the Kenilworth Motor Truck Corporation, of Seattle, Washington Each unit weighs 15 tons and has eight huge wheels for use on ramps Twenty-two feet long and sixteen feet wide, the big device has sufficient air tankage to provide approximately 2000 lb excess buoyancy, Provision is made for flooding certain of the tanks to release the Clipper plane being launched. To assure rigid support of the 82,000 lb Boeing flying boats, the beaching gear is constructed by electrically welding the entire frame into a single rigid steel unit Approximately 175 lb. of General Electric type W-20 electrodes were used in the fabrication of each gear. In tests it was found that the gear was so rigid that, with 41 tons load, no corner of the gear could be lifted more than ⅛ in. out of line without lifting the entire side of the gear—AVIATION, *July, 1938*

Standby Generator

By Caterpillar, finds airport applications

THE "CATERPILLAR" D8800 diesel electric generator set, manufactured by the Caterpillar Tractor Co., Peoria, Ill., is finding application as an emergency lighting plant at airports. At the Syracuse Airport, Syracuse, N. Y., one of these units, equipped with an automatic cutover to the auxiliary unit, has repeatedly demonstrated, in tests, its ability to maintain airport lighting without interruption in the face of complete failure of the normal power supply, This service is absolutely essential during night landings of large transport planes, when sudden failure of the power supply, with consequent loss of major flood lighting units, might cause the pilot engaged in landing serious trouble.—AVIATION, *July, 1938*

Lok-Skru Fastener

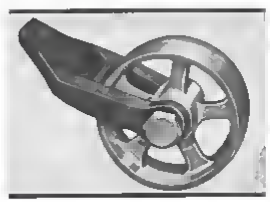
Dill Device reduces labor as much as 80 per cent

DEVELOPED with the cooperation of engineers of the Douglas Aircraft Company, and approved for certain aircraft application, the Dill LOK-SKRU Fastener, manufactured by the Dill Manufacturing Company, Cleveland, Ohio, is now being offered to the aviation trade. Applications include the attachment of nacelle, wing, and other fillets, interior upholstery panels, deicer shoes, door frames, miscellaneous fairings etc Labor time is said to be reduced as much as 80 per cent through use of the LOK-SKRU fastener. One man alone with a special tool, can quickly apply LOCK SKRU fasteners Metal gauges from 01 to 185 are handled by LOK-SKRUS in three sizes—AVIATION *July 1938*

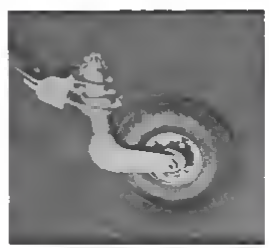
Light Plane Tail Wheels

Three Types Offered by Universal Alloy Products

THREE TYPES OF TAIL WHEELS for light aircraft have been announced by the Universal Alloy Products Co, of Lancaster, N Y The H-60 is an all-metal assembly attaching to the conventional spring-leaf skid. It is non swivelling and has an alloy hardened wheel 3½ in in diameter equipped with Hyatt roller bearings Total weight is 2 lb Type H-3 is designed to provide complete maneuverability for light aircraft. It has a 6x2 in tire mounted on a fully swivelling fork with sealed swivelling mechanism slightly dampened to prevent loose action in flight. This model is easily installed on any plane equipped with a spring leaf type skid Type 'H-2" is very similar to the H-2 except that it is designed for attachment to the Aeronca K only A complete line of hardened alloy tail

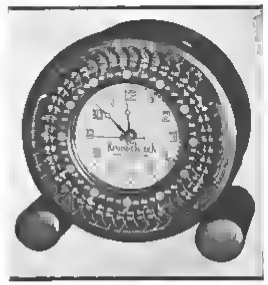


H 60 All Metal Model



Tire type H-3 Wheel

wheel shoes is also manufactured, including No 117, a large Spoon type for the Piper Cub and other light aircraft—AVIATION, *July, 1938*



James Remind-O-Clock

Remind-O-Clock

It remembers so you can forget

SHH! Here's an item that this editor needs in his office the worst way Ah! How many, many things we have "forgotten to remember"! But if we had a James Remind-O-Clock, manufactured by the Remind-O-Clock Corp, San Francisco, Calif, we could go on back to sleep and let the clock remind us to wake up when this item was written According to the makers there is no item of human activity which cannot profit from the use of the unique Remind-O-Clock, and they must be right because we note from their literature that this clock is already in use in every state in the union, and the District of Columbia In the latter location it is used to remind Congressmen when a session terminates so they can wake up and go home. In other places it is used by hotels, hotels, hotels and hotels, also air lines, cab companies, aircraft factories, aviation executives, funeral homes, homes, etc This astonishing clock is an electric instrument that may be set to remind you as many as forty-eight times a day It is manufactured in two models, one of which is equipped with a buzzer and red light signal. You can shut the buzzer off at will but the red light stays on until the clock personally sees you get up and go do whatever it was you were being reminded about. The other model has an electrical outlet into which small electrical appliances may be connected—AVIATION, *July, 1938*

Going Places In 1938?

Then Let This FREE BOOK Help You

NEWCOMER or old timer—you will find practical tested ideas in the pages of this book, specially compiled by the editors of AVIATION to meet the needs of Students, Pilots, Mechanics, Plane Owners, Fixed Base Operators, Transport and Airport Men. It is yours without cost with your subscription to AVIATION—the monthly issues of which bring you equally practical ideas for making your way in your chosen work.

While we call the book "Money Making Ideas" it's not a mere collection of ways in which to earn cash. It is filled with fresh, inspiring ideas that are self starters for live wire men. It's the kind of a book that encourages you to head for the top—by showing you how other men (many with such handicaps as no money, small town locations, etc.) have forged ahead and realized their aviation ambitions.

If you're just starting out—if you're experienced but feel you're in a groove—if you're impatient to get ahead *faster* —this book and the monthly issues of AVIATION can help you with these aims. Thousands of our readers who started with us as students are now important men in the world of flying. They claim that the all round coverage and information brought them by AVIATION has helped them to advance. This same material can help you. And the cream of much of it is contained in the pages of "Money Making Ideas" which comes to you free.

Forward MARCH In Your Flying Career . . . with AVIATION and this 128 page, practical book

Dollars from Photography—How to Buy a Plane on $20 a week Income—Finding Jobs for Students—Ideas for Charter Service—Fixed Base Problems and Income —Instrument Training from Scratch—Flying Under the Hood—How An Airplane Opens the Door for the Salesman — The Low-Priced Airplane — Maintenance Kinks and Short Cuts—Trends in Sightseeing, Photography, Dusting—Aircraft at Work, as Told by users of Business Planes—and many other articles for everyone interested in the flying industry.

To get your *free* copy of "Money Making Ideas in Aviation" simply use the handy form below. Every paid-in-advance new or renewal subscriber may have a copy of this helpful book, without cost. Send only the regular subscription fee—$3, one year, $4 two years —and your book will come to you at once. There may be just the ideas you need in the pages of this book. Let it, and the monthly issue of AVIATION help you go places in flying. Get your copy at once by filling out the convenient form below and mailing it to us NOW.

Mail this Coupon at Once!

Aviation, 330 W 42nd St., New York, N. Y.

I enclose $4. Enter my subscription to Aviation for two years and send me "Money Making Ideas in Aviation" free. I'll pay expressman 15c delivery charges.

( ) If renewal order please check here.

( ) For 1 year subscription enclose $3 and check here.

Name _____

Address _____

City _____ *State* _____

Company _____

Position _____ 7-38

This Offer Good Only in United States Possessions and Canada

Attention: Present Subscribers

You may obtain a copy of this FREE book by renewing your present subscription. *Regardless of when your present subscription expires,* you must send in another PRE-PAID renewal order. Your subscription will be extended for additional time without duplication. Mail in your order and payment today.

[All books are sent out by express to insure safe delivery. There is a small charge of 15c—payable to the expressman upon delivery of the book.]

THE AVIATION NEWS

REVIEW, COMMENT, FORECAST

JULY 1938

DANIEL SAYRE

C. F. McReynolds *Pacific Coast*

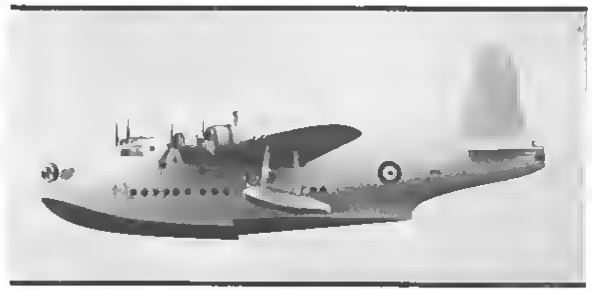
Blaine Stubblefield, *Washington*

E. R. Locke, *New York*

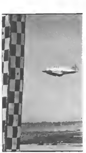
Commission Law Wins Long Battle

(Story on page 53)

THE SKIES OF EUROPE—grew darker with aircraft as every nation on the continent steps-up appropriations for aerial armaments. Above, 54 high-speed Italian bombers thunder over the reviewing stand as Il Duce shows off his planes to Der Führer. At the right, England's new flying dreadnaught the Short-built Sunderland shows its paces. Equipped with four 1,000 hp. Bristol Pegasus engines, it cruises at better than 200 m.p.h., ranges 3,000 miles, carries gun turrets fore and aft in addition to a large bomb load.



Racers Top Marks At Oakland Meet



THE CROWDS — totalled almost 100 000 for the three days May 29-31. The plane entries showed good technical progress. The third daily race broke the American close course record. Frank Fuller made a record flight from Vancouver at 288 m p h. Debits: The death of Ralph Johnson, Los Angeles Waco dealer, while stunting. The death of Gus Gotch in the second day's race

THE STUNTING — was excellent. Alex Papana, Tex Rankin, Paul Mantz, Frank Clark, Dick Granere were headliners

THE HERO—of the racing was Tony LeVier, up for his first crack at big league racing. He won both 550 cu in events, came third in the free for all at 250.782 m.p.h. All in a Menasco-powered Schoenfeldt.

THE WINNERS—of the featured 150-mile race finale. In the background the Twin Wasp Jr powered Marcoux-Bromberg that Earl Ortman pushed to an average of 255.593 m p h. In the foreground, the Twin Wasp Sr powered Turner-Laird in which Roscoe Turner finished a close second at 254.638 m p h

SPOT LANDINGS

On the Month's News

How to steer rockets doesn't bother many people—yet. But Dr R. H. Goddard of Clark university laboring in his rocket lab at Eden Valley, N. M., has been concentrating on that problem since his last progress report two years ago. As long as his gasoline-oxygen sounding rockets are still discharging fuel, he is satisfied his gyro-operated rudders will do the trick. Beyond that lies about 30 per cent of the potential range. Even in this momentum zone the doctor feels he is making progress.

The Daniel Guggenheim Medal for 1938 has been awarded by the Institute of the Aeronautical Sciences to A. H. R. Fedden, chief engineer of the Bristol Aeroplane Company of England "for contributions to the development of aircraft engine design and for the specific design of the sleeve valve aircraft engine". American engine men are loud in their applause.

The Post Office means business, when it talks plans for feeder lines. Last month Harllee Branch told a House committee that immediate objectives include star route services in the Rocky Mt. and Great Lakes regions, a regular air mail service between Seattle and Juneau, various experimental feeders and field-to-post-office giro shuttles.

France has won over Portugal and is finally settling last details of an agreement to let Air France Trans Atlantique use the Azores. Aside from that, reports from Europe tell of little prospect toward scheduled crossings with passengers and mail (see page 64 for further details). Meanwhile latest gossip has Pan American going ahead on an Azores Lisbon "all year-round" route with a start likely this fall using two or more of the new Boeings.

With profound regret we report the death last month after a long illness of Frederick W. Neilson, a graduate of the Naval Academy, a former president of United Export Corporation and retired president of Sikorsky Aircraft Company.

For the ninth consecutive year the National Soaring Society opened its big-time contest at Elmira, New York. Preliminary reports were of forty motorless craft and at least a hundred pilots entering the sixteen days of competition. Dr. Karl Lange of Harvard was once more to serve as Contest Chairman. Earl Southee was once more contributing his usual heavy labours. Major awards included the Warren E. Eaton, the Vincent Bendix, the A. Felix duPont, the Evans and the "Air Trails". Several thousands of dollars were available for prize money.

Civil Aeronautics Authority Will Have Administrator, Five Members, Separate Three-Man Safety Board

INDUSTRY OBSERVERS were beginning to get jittery lest the 75th Congress should wind up the present session without taking action on the Lea-McCarran bills, but the skies began to clear when both the House and the Senate acted and sent the two measures into Conference Committee for reconciliation. The Committee report was approved in the House on June 11th and in the Senate on the 14th, and as we go to press it has been signed by the President and is now a law of the land.

As it now stands, the bill occupies 63 pages of solid type and obviously cannot be reproduced in full here.

Most important is the official declaration of policy (section 2) which reads as follows.

SEC. 2. In the exercise and performance of its powers and duties under this Act, the Authority shall consider the following, among other things, as being in the public interest, and in accordance with the public convenience and necessity—

(a) The encouragement and development of an air transportation system properly adapted to the present and future needs of the foreign and domestic commerce of the United States, of the Postal Service, and of the national defense;

(b) The regulation of air transportation in such manner as to recognize and preserve the inherent advantages of, assure the highest degree of safety in, and foster sound economic conditions in such transportation, and to improve the relations between, and coordinate transportation by, air carriers;

(c) The promotion of adequate, economical, and efficient service by air carriers at reasonable charges, without unjust discriminations, undue preferences or advantages, or unfair or destructive competitive practices;

(d) Competition to the extent necessary to assure the sound development of an air transportation system properly adapted to the needs of the foreign and domestic commerce of the United States, of the Postal Service, and of the national defense;

(e) The regulation of air commerce in such manner as to best promote its development and safety; and

(f) The encouragement and development of civil aeronautics.

Organization is covered in Title II, of which section 201 says:

(a) An agency is created and established to be known as the Civil Aeronautics Authority which shall be composed of five members who shall be appointed by the President by and with the advice and consent of the Senate as soon as practicable after the passage of this Act, and who shall continue in office as designated by the President at the time of nomination through the last day of the second, third, fourth, fifth and sixth calendar years respectively, following the passage of this Act. The President shall designate annually one of the members of the Authority as chairman and one of the members as vice chairman who shall act as chairman in the absence or incapacity of the chairman. The members of the Authority may be removed by the President for inefficiency, neglect of duty, or malfeasance in office. No more than three of the members shall be appointed from the same political party. Each member of the Authority shall receive a salary at the rate of $12 000 per annum. (b) There shall be in the Authority an Administrator who shall be appointed by the President by and with the advice and consent of the Senate, and who shall receive a salary at the rate of $12,000 per annum.

(c) The members of the Authority shall be appointed with due regard to their fitness for the efficient dispatch of the powers and duties vested in and imposed upon the Authority by this Act. No member of the Authority or the Administrator, shall engage in any other business, vocation, or employment.

Provision is also made for the appointment of a secretary for the Authority, a general counsel, a director for each bureau, and such other subordinate personnel as the Authority may deem necessary, in performance of its powers and duties. Provision is also made for transfer of such officers and employees of the Post Office, the Interstate Commerce Commission, and the Bureau of Air Commerce as are deemed necessary; also unused portions of appropriations of these departments (for aviation use) are transferred to the Authority. The law states that the Authority may purchase aircraft for its own use; also that members may travel on airlines. The Authority is further empowered to cooperate with existing state and other governmental agencies and to keep a complete record of its doings, and to publish a complete annual report.

Specific duties are laid upon the Ad

Eenie, Meenie, Minee, Mo . . .

Blaine Stubblefield has a formula for who is going to get the jobs: climb into a Washington taxicab and ask one of those gabby drivers,—they know more about such things than all congress and both press galleries laid end to end—and you'll probably hear a list including Grant Mason, Harllee Branch, Norman Haley, E. P. Warner, William Burden and D. C. Dobbins. But don't bet money yet!

Accident Reports

B. of A. C. issues findings. Missing ship located in California.

ON THE CRASH near Saugus, Calif., May 16, in which nine persons were killed in a Lockheed 14 being delivered by the factory to Northwest Airlines, the Bureau's board found that the pilot, Sidney L. Willey, had been guilty of "the continuation of contact flying through mountainous country and over sharply rising terrain into weather conditions that made further contact flight over the route in question impossible." Among those lost on board the plane were Fred Whittemore, operations manager for Northwest, and the family of Carl Squier, sales manager for Lockheed.

On the accident May 24, in which ten were killed in a United Airlines DST just outside the Cleveland Airport, the Bureau found that one engine had undoubtedly failed mechanically, causing a fire in the accessory end of its nacelle. The pilot, James L. Brandon, had properly sought to land as quickly as possible and would probably have completed a safe approach to level ground had not his landing wheel struck the top of a high tree at the edge of the gulley into which the ship was thrown.

On June 12, a prospector in Yosemite Park found the wreckage of the TWA DC2 which disappeared March 2 during the storm which caused floods throughout lower California.

Orders Pour In On Lockheed Aircraft; North American Shares British Harvest

THE CAVE-MAN who first made the crack about "It never rains but it pours" couldn't have been thinking about orders for Lockheed airplanes. But never in all the eons of its existence has that particular gag been so well illustrated as it was last month.

Business at Mr Gross' Burbank plant seemed healthy enough to begin with. During the first four months of this year deliveries had been worth $2,560,000, almost a million better than for the same period in 1937. Interestingly, some 85 per cent had been for export to Canada, Rumania, England, Australia, Jugoslavia, Argentina, Poland and Holland. Then Union Airways of New Zealand ordered two more Electras. British Airways ordered four Lockheed 14's. The U. S. Air Corps came through with a contract for thirteen Lockheed 19's for troop transport and twin-engined training. Suddenly, umph . . . the British Air Ministry announced an order for 200 militarized versions of the Lockheed 14 for a reputed $17,000 000. The Ministry also announced it was buying 200 North American NA16's. It would use both types largely for advanced training, it said, thus permitting England's factories to concentrate on "first line" equipment. If our cousins have anything much more first line than a 14 rigged up as a bomber and mounting twin thousand hp engines, we'd like to see it. (*C. G. Grey please note!*)

AVIATION IN WASHINGTON

by BLAINE STUBBLEFIELD

McCarran-Lea'ers Say a few words into AVIATION'S mike

Senator Pat McCarran: "My bill as reported by the conference committee will free civil aviation from confusion and thus give encouragement and assurance to the industry and those who have given their time, study and sustenance to this great agency of commerce and national defense, so that American capital and energy will go forward to put this country in the leadership of the world in air commerce. The bill when put into operation as a law will assure to labor engaged in this line of endeavor the highest degree of encouragement and protection, and to the traveling public the greatest degree of safety. This bill is a triumph for science and industry."

Senator Harry S. Truman: "I think it's a good bill. It has been very carefully drawn up. It has the best points of the House bill and the Senate bill in it, and the best of suggestions that came from the executive departments. I don't believe that we could have gotten a better bill than the one agreed on by the conferees. Testimony before the committees showed that the industry expects to be better off under the measure. We put the opinions of the people in the industry above our own, that is why we passed the bill."

Senator Royal S. Copeland: "Senator McCarran's bill, creating the new Civil Aeronautics Authority, should prove a stimulation to the whole aviation industry. It has long been the hope of my committee that such a centralized body would be set up to control aeronautics. With an Administrator to carry out quickly the executive functions, and an impartial Authority to hold hearings and to sit in studied judgment, the aeronautical industry should now be ready to go forward with all the confidence necessary for future expansion."

David L. Lewis: "The new civil air law is sound because it centers all branches of civil aviation in one agency. The pilots are satisfied with provisions for minimum wages and maximum hours. The law requires as a condition for certification that scheduled air transport companies comply with the Railway Labor Act as amended. Provision for the Air Safety Board is especially satisfactory. This is the first time accident prevention and investigation have been given a definite legal status. Effectiveness of both the Authority and the Safety Board will depend largely on the qualifications of those appointed to serve as members. If the new law is properly administered it will make American air transportation the greatest in the world by making it the safest."

National Aeronautic Association is in the black and hopes to have all debts paid by September, when it will expand services. Is seeking to coordinate all aviation conferences to avoid conflicts. In last few months enrolled 2,163 substantial business men and civic leaders, enlisting public support for aviation. Income for May was $6,083.19, only $1,774.96 went for salaries, showing a lot of experience and work contributed to NAA. Conducting a drive to get 3,000 new members this year.

Windmilling around Washington, by courtesy of Mr. Kellett, pleased congressmen who took rides and brought the $2,000,000 rotor-wing development, proposed in the Dorsey bill, nearer to reality. An objection in the House lost the bill its turn for consideration this session, but its chances next Congress are good. Commerce, Agriculture, Coast Guard, Army, etc., would use the money. The Kellett corporation thinks the sale of 5,000 giros would break the volume-cost circle so private flyers could buy. Volume would bring the price down to quality-car level.

Loading the heroes of air commerce with personnel to be transferred to the civil aeronautics authority for political advantage is charged by the Bureau's detractors. This writer has checked the Bureau's records and finds 167 persons added to rolls this year, whereas rumor had it several hundred. Washington office gained 11, inspection and traffic gained 20, maintenance of navigation, 105, establishment of navigation facilities, 26, safety and planning, 3, safety and planning in the field, 2, total 2756. Congress had authorized 3487 as of July 1, 1939. Bureau business is already being sharply tapered toward the end. As for politics, officials point out that the President's order of March 28 blanketed the Bureau under civil service except the director and two assistants, and 10 experts. This makes political hay-making difficult.

International

PHARAOH NEVER DREAMED—of anything like this. But President Roosevelt last month told congressional leaders he had dreamed of a big crack-up right in the middle of the Washington airport and to get busy and do something about it. Specifically he said the House should pass a bill to build a $10,000,000 national air terminal at Camp Springs, Md. The Senate had already given its Okay. But a couple of representatives stood up during the final days of the session and yelled the Camp Springs deal wuz being made a land grab of, so a jittery house buried the action. Trouble is that people are said to be interested realtor-wise in every open space within driving distance of the capitol and each group plays all the politics it can.

Aeronautics Law

(Continued from page 53)

minustrator within the Authority as follows:

Sec. 301. The Administrator is empowered and directed to encourage and foster the development of civil aeronautics and air commerce in the United States, and abroad, and to encourage the establishment of civil airways, landing areas and other air navigation facilities. The Administrator and the Air Safety Board shall cooperate with the Authority in the administration and enforcement of this Act.

Sec. 302. (a) The Administrator is empowered to designate and establish civil airways and, within the limits of available appropriations made by the Congress, (1) to acquire, establish, operate and maintain along such airways all necessary air navigation facilities, (2) to chart such airways and arrange for the publication of maps of such airways, utilizing the facilities and assistance of existing agencies of the Government so far as practicable, (3) to acquire, establish, operate and maintain, in whole or in part, air navigation facilities at and upon any municipally owned or other landing area approved for such installation, operation or maintenance by the Administrator, and (4) to provide necessary facilities and personnel for the regulation and protection of air traffic moving in air commerce.

(c) The Authority shall, through the Administrator, make a field survey of the existing system of airports and shall present to the Congress not later than February 1, 1939, definite recommendations (1) as to whether the Federal Government should participate in the construction, improvement, development, operation or maintenance of a national system of airports, and (2) if Federal participation is recommended, the extent to which and the manner in which the Federal Government shall so participate.

Most important provision of the new law for air transport operators is the inauguration of a system of Certificates of Convenience and Necessity. According to section 401—

(a) No air carrier shall engage in any air transportation unless there is in force a certificate issued by the Authority authorizing such air carrier to engage in such transportation.

The certificates as issued will specify in great detail the routes over which a carrier can operate and the conditions under which he must operate. It provides also that operators who were engaged in air transportation on or before certain dates automatically become eligible to receive certificates without further evidence of ability to perform satisfactorily over the routes they have been using.

The authorization of the Authority is take over the functions now exercised by the Bureau of Air Commerce are contained in section 601 as follows.

Sec. 601. (a) The Authority is empowered and it shall be its duty to promote safety of flight in air commerce by prescribing and revising from time to time—

(1) Such minimum standards governing the design, materials, workmanship, construction and performance of aircraft, aircraft engines, and propellers as may be required in the interest of safety;

(2) Such minimum standards governing appliances as may be required in the interest of safety;

(3) Reasonable rules and regulations and minimum standards governing, in the interest of safety (A) the inspection, servicing and overhaul of aircraft, aircraft engines, propellers and appliances, (B) the equipment and facilities for such inspection, servicing and overhaul, and (C) in the discretion of the Authority, the periods for and the manner in which such inspection, servicing, and overhaul shall be made, including provision for examinations and reports by properly qualified private persons whose examinations or reports the Authority may accept in lieu of those made by its officers and employees;

(4) Reasonable rules and regulations governing the reserve supply of aircraft, aircraft engines, propellers, appliances and aircraft fuel and oil, required in the interest of safety, including the reserve supply of aircraft fuel and oil which shall be carried in flight;

(5) Reasonable rules and regulations governing, in the interest of safety, the maximum hours or periods of service of airmen and other employees of air carriers; and

(6) Such reasonable rules and regulations or minimum standards governing other practices, methods, and procedure as the Authority may find necessary to provide adequately for safety in air commerce.

(7) Air traffic rules governing the flight of, and for the navigation, protection, and identification of aircraft, including rules as to safe altitudes of flight and rules for the prevention of collisions between aircraft, and between aircraft and land or water vehicles.

An outstanding feature in the new law is the creation of a safety board, as follows:

Sec. 701. (a) There is created and established within the Authority an Air Safety Board. Such Board shall consist of three members to be appointed by the President by and with the advice and consent of the Senate. One of the members shall at the time of his appointment be an active airline pilot and shall have flown not less than three thousand hours in scheduled air transportation. Each member of the Board shall be a citizen of the United States and shall continue in office as designated by the President at the time of nomination until the last day of the second, fourth and sixth calendar years respectively following the passage of this Act, but their successors shall be appointed for terms of six years except that any person appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed only for the remainder of such term. Any member of the Board may be appointed to succeed himself. The Board shall annually elect one of its members as chairman of the Board. Each member of the Board shall receive a salary of $7,500 per annum. No member of the Board shall have any pecuniary interest in or own any stock in or bonds of any civil aeronautics enterprise.

Section 702 outlines the duties of the safety board as follows:

Sec. 702. (a) It shall be the duty of the Board, in—

(1) Make rules and regulations subject to the approval of the Authority, governing notification and report of accidents involving aircraft;

(2) Investigate such accidents and report to the Authority the facts, conditions, and circumstances relating to each accident and the probable cause thereof;

(3) Make such recommendations to the Authority as, in its opinion, will tend to prevent similar accidents in the future;

(4) Make such reports and recommendations public in such form and manner as may be deemed by it to be in the public interest; and

(5) Assist the Authority in ascertaining what will best tend to reduce or eliminate the possibility of, or recurrence of, accidents by investigating such complaints filed with the Authority or the Board and by conducting such special studies and investigations, as matters pertaining to safety in air navigation and the prevention of accidents, as may be requested or approved by the Authority.

EDWARD E. (TED) WYMAN
Leaves Pan Am for Curtiss-Wright

GUY VAUGHN, C-W president, has announced the addition of two new vice-presidents to the officers of the Curtiss-Wright Corporation, Edward E. Wyman, for the past ten years assistant to Juan Trippe of Pan American Airways, served in naval aviation during the War, was later in charge of sales for the Mack Truck Corp. William F. Goulding has been with Curtiss-Wright since 1928 and was vice-president of Curtiss-Wright Export before its absorption. Goulding has spent almost twenty years in the export field.

AVIATION BOOKS
In Tabloid Review

ELEMENTARY AIRPLANE STRUCTURAL ANALYSIS BY GRAPHIC METHODS, *by James P. Eames*, Aviation Press, San Francisco, Cal., 1938; 180 pp (typewritten and offset, paper cover, spiral binding); $3.

It is a pity that this effort couldn't have been a better one, for the subject holds considerable interest for students of stress analysis everywhere. But there are enough engineering errors and misleading statements in evidence from even a preliminary inspection to suggest that an inexperienced reader might easily get into serious trouble if he attempted to use this book in the design of an airplane. Obviously, the subject is much broader than the author suspected, and he was soon carried well beyond his depth.

PRACTICAL AERONAUTICAL ENGINEERING, *by Willis L. Nye*, Aviation Press, San Francisco, 1938, 127 pp and index (typewritten, offset, paper cover, ring binding), $4.

In a different category from the graphic structures book reviewed above. A workmanlike job, with a great deal of useful data on aircraft design procedure and technique of the handbook type. We like particularly the drawings that are used to illustrate it throughout. The author has made good use of excellent pen and ink sketches of actual aircraft of many types in place of the usual conventionalized drawings, a feature which lends considerable reader interest.

LET'S TALK BUSINESS

Gordon Carr, former executive for Boeing and Martin, has been elected president of Menasco Manufacturing Company, Al Menasco taking the position of vice-president. Robert E. Gross and Cyril Chappellet, Lockheed officials, have become Menasco directors. A joint statement by both companies denies any corporate affiliation between the two corporations.

A Navy contract for $1,919,395 has been awarded to Brewster Aeronautical Corporation of Long Island City, N. Y. Naval officials decline to specify types or number of planes involved.

Sperry Gyroscope is handling such heavy aeronautical business on the West Coast. It has moved its Los Angeles district office to new and much larger quarters at 2800 West Imperial Highway, El Segundo, (Mines Field), Calif. In addition to the office a repair station and school will be set up.

Mr. Guy Vaughn announced last month that the C-W's newly formed propeller division will soon move to new quarters in the large factory building located at Lakeview Ave., Clifton, N. J.

Spyer possesses a military version of its sport training plane, following recent military orders from Mexico, Honduras and Guatemala. The new STM will be powered with the supercharged Menasco C4S engine of 150 hp.

Approximately 75 per cent of 130,818 additional shares of Western Air Express Corp. were subscribed to by stockholders prior to May 25th last. The balance was underwritten by a Denver investment firm.

Bell Aircraft of Buffalo has received an Air Corps contract for 13 of its twin-engined pusher "Airacudas." They are to cost $3,195,295.

Allied Aviation Corp. of Los Angeles, Calif., a new aircraft engine firm, has been granted a California permit to issue 600,000 shares of $1 par value stock. It plans to manufacture the French Regnier inverted in-line engine of 90 hp. under license.

Kinner Airplane & Motors' president, Robert Porter, has resigned. Earl Herring, general manager of Airplane Parts & Supplies, has been appointed to serve as trustee and general manager.

Lockheed Aircraft has changed the name of its wholly-owned subsidiary, the Air Rover Company, to Vega Airplane Company. It will manufacture a medium sized cabin plane, mounting two Menasco engines geared to a single propeller through a free wheeling arrangement.

Donald W. Douglas has been reelected Chairman of the Board and President of the Douglas Aircraft Company. Geoffrey Mayo, a director, has been elected to fill a vacancy on the executive committee caused by the resignation of Richard W. Millar. Officers for 1939 include Harry H. Wetzel, senior vice-president, Carl A. Cover, vice-president, A. E. Raymond, vice-president; John M. Rogers, vice-president; T. C. McMahon, secretary; H. P. Grube, treasurer; and William E. Douglas, assistant treasurer.

Deliveries for the five and a half months ending May 13 totalled $13,949,033. Current unfilled orders are $26,500,000. There were 6,674 employees on the company's payroll as of June 1st.

Stanovo Specification Board, following the retirement of Major E. E. Aldrin, announces R. C. Oertel will continue in charge of the company's domestic aviation sales and Major R. E. Ellis will head up the experimental testing and development phases of Major Aldrin's work.

Grumman Aircraft Engineering has received an Air Corps contract for 26 amphibians and spare parts amounting to $1,412,916. To be fitted with Pratt & Whitney Wasp Juniors, they are to be assigned throughout our insular possessions. It represents the first Grumman sale of amphibians to the Army.

Four Months Production Beats 1937 by 55 Per Cent

	—This Year—		—Last Year—		Value Ratio
	Units	Value	Units	Value	1938 to 1937
Military Planes	448	18,741,577	154	7,879,232	2.38
Mil. Plane Spares		3,118,302		2,616,106	1.19
Military Engines	882	5,963,534	661	4,740,028	1.26
Mil. Engine Spares		1,622,292		1,223,480	1.32
Total Military		29,445,705		16,463,846	1.79
Civil Planes (single-engined)	525	1,092,592	489	1,239,002	.88
Civil Planes (multi-engined)	59	4,774,477	69	5,002,439	.96
Civ. Plane Spares		4,009,761		1,949,595	2.06
Civil Engines	1172	4,471,097	1178	4,614,307	.97
Civ. Engine Spares		1,939,839		1,226,839	1.57
Total Civil		16,287,755		14,032,182	1.17
Total Military and Civil		45,733,460		30,496,128	1.55

Exports (including chutes and accessories) for the four months' period totaled $21,339,534—107 per cent ahead of last year's first four months' figure. Prediction data by the Aeronautical Chamber of Commerce. Export figures from the Department of Commerce.

PROFITS AND LOSSES

» AIR ASSOCIATES, INC., for six months ending March 31, 1938, a net profit of $58,990, equal to 50c each on 99,884 shares of $1 par common stock. Compares with net income of $31,768 or 27c per common share for same period last year. Declared a quarterly dividend of 12½c. per share on the common stock, payable June 25, against 10c paid previously.

» BEECH AIRCRAFT CORP., for six months ending March 31, 1938, net loss of $35,364. Same period last year net profit of $3,126 equal to 1c. each on 259,349 shares.

» CESSNA AIRCRAFT CO., for quarter ending March 31, 1938, net income $775. For year ending December 31, 1937, net income of $1,022, against $326 for 1936.

» FAIRCHILD AVIATION CORP., for quarter ending March 31, 1938, net profit of $38,432, equal to 11c. a share on 337,032 capital shares outstanding Dec. 31, 1937. Net profit for same period last year, $1,042, or 4c. each on 327,032 shares.

» PENNSYLVANIA-CENTRAL AIRLINES CORP., for quarter ending March 31, 1938, net loss of $50,577, as against $106,041 loss for same period last year.

» UNITED AIR LINES TRANSPORT CORP., for quarter ending March 31, 1938, net loss of $667,670 compared with loss of $402,735 for same period last year. Although revenues increased 6.6 per cent, operating expenses and taxes increased 9.2 per cent over the same quarter for 1937.

AVIATION PEOPLE

Who's Who in This Month's News

DOCTOR. Edward P. Warner, consulting engineer and member of the N.A.C.A., has headed the courses in aeronautical engineering at the Massachusetts Institute of Technology, served as Assistant Secretary of the Navy for Air, been editor of AVIATION MAGAZINE, and Vice-Chairman of the Federal Aviation Commission. Last month he received a tribute long due his scholarship, his brilliance and his leadership — an honorary doctorate in aeronautical engineering from Norwich University of Northfield, Vt.

International

TUNNELERS. Dr Clark B. Millikan, professor of aeronautical engineering at the California Institute of Technology, discusses details of boundary layer research with student A. M. O. Smith. Dr Milliken is a past president and Fellow of the Institute of the Aeronautical Sciences.

Wide World

SPARK PLUGS. Sir Kingsley (Cherub) Wood, Great Britain's newly appointed Air Minister, watches an R.A.F. formation passing over Admiral House as Capt. H. Balfour, M.C., Under-Secretary for Air, points out details. For a full description of England's new air armament plans see page 54. Its success or failure will depend a great deal on the efforts of these two men.

EXPRESSMEN: C. G. Peterson has been appointed Chief Engineer of the Railway Express Agency, where for some years he has been serving as superintendent of organization. Earlier experience includes sales direction for Wright Aeronautical and for the airplane division of Ford Motor.

International

SOUTH SEA ISLANDERS—left to right: Lewis Yancy, navigator; Richard Archbold, captain; Russell Rogers, pilot; Ray Booth, radio. These men lifted their Consolidated Gube off San Diego harbor June 2, landed at Pearl Harbor June 7 they crossed direct to Wake Island. On June 9 they finished a pioneer 2300 mile crossing to Dutch New Guinea. Archbold will use the big ship in a two-year research expedition.

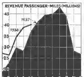
International

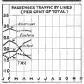
POLE VAULTERS—left to right: S. Piskorz, flight engineer; Z. Wysiekierski, transport pilot and controls relief; Major Waclaw Makowski, flight leader; A. Rzeczewski, radio operator. Jerzy Kraszewski, assistant to Major Makowski, was also on board their Hornet powered Lockheed 14 when it left Los Angeles May 13 on a fly-away delivery via Chile, Brazil, Africa and Rome to Warsaw, where they arrived June 5.

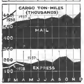
MANAGER: Captain Griffith Powell has taken up duties as operations manager for Imperial Airways at Bermuda, succeeding Captain William Armstrong. Captain Powell last summer commanded the Empire boat Cambria on four Atlantic crossings.

BIRTHDAYER: T. E. Braniff, founder and president of Braniff Airways, last month helped celebrate that system's tenth anniversary. Mr Braniff has watched his creation grow from a 5-man, one Stinson out fit to a big 10,000 mile a-day Electra and Douglas system of major stature.

DIRECTOR: Herbert L. Sherlock, Vice President and director of publicity for the Bendix Products Corporation, has been advanced to the position of Director of Public Relations for Bendix Aviation Corporation. In a recent general re-alignment of Bendix officials.







AIR TRANSPORT INDICATOR

June 1, 1938

115.8

Which is the ratio of the revenue passenger miles reported by the Air Transport Association as carried by all domestic airlines during May 1938, to the corresponding figure for May, 1937.

For the fifth consecutive month the indicator stands well over 100 First five months totals, 1937 — 133,414,134; 1938—168,678,268, up 25.5 per cent.

LOGGING THE LINES

Air Transport Drift Sights

by DAN SAYRE

How does your air line stand in the box score?

We got to fooling around last month with the air line statistics in the May 15 Bulletin of the Bureau of Air Commerce You know, the ones giving the mileage and traffic results for each air line's 1937 business. Before we knew it, we had a big bundle of sheets all covered over with tables and listings Here are a few of them for what they might be worth.

Listing the domestic mail lines in operation all twelve months by Miles-Flown the tables comes out like this

Air Line	Miles Flown	Pass. Miles	Express Lb. Miles	Mail Lb. Miles	Mail Pay
United	1st	2d	1st	1st	1st
American	2d	1st	2d	2d	2d
TWA	3rd	3rd	3rd	3rd	3rd
Eastern	4th	4th	4th	4th	4th
Northwest	5th	8th	6th	5th	5th
Braniff	6th	7th	7th	7th	7th
Penn-Central	7th	6th	8th	6th	8th
WAE	8th	5th	9th	8th	6th
Chi. & South	9th	9th	5th	9th	9th
Delta	10th	10th	10th	10th	10th
Hanford	11th	11th	11th	11th	11th
Boston-Maine	12th	12th	13th	14th	12th
Continental	13th	13th	12th	13th	13th
National A.T.	14th	14th	14th	12th	14th

This seemed to show an astounding co-relation among all departments Was everything as uniform as it seemed? We tried it another way Dividing Passenger-Miles, Express-Pound-Miles and Mail-Pound-Miles by the Mileage-Flown for each line we came out with a sort of imaginary average load thus

Air Line	Average Pass. (No.)	Average Express (Lb.)	Average Mail (Lb.)
United	7 15	34	281
American	5 55	35	176
TWA	6 75	36	271
Eastern	5 25	32	179
Northwest	4 35	26	194
Braniff	4 18	45	153
Penn-Central	5 85	30	62
WAE	4 65	69	172
Chi. & South	4 34	30	81
Delta	3 55	14	77
Hanford	3 47	16	47
Boston-Maine	4 92	5	19
Continental	1 9[illegible]	3	33
National A.T.	2 14	5	30

This showed up a great deal more spread between the big lines and the smaller ones, but again the variation was a lot more uniform than one might have thought Bearing in mind the type and size of plane used by the different operators, load factors over the air map must fall pretty close to a mean value

So we tried one more method—in average income per mile. We estimated 4 5 cents per passenger mile, taking into account that the Bureau figures include all dead-heads Mail pay came after some simple dividing Once more we find pretty general uniformity within each equipment group also some pretty wide divergences Pay per pound-mile carried is put in just for the sake of argument—if you feel like arguing

Air Line	Pass Income (cents)	Mail Income (cents)	Pass. plus Mail Income (cents)	Mail Pay per Lb. Mile (cents)
United	38 2	16 0	52 1	071
American	36 8	17 7	47 5	090
TWA	33 4	13 8	37 7	096
Eastern	37 [illegible]	17 [illegible]	55 4	104
Northwest	18 [illegible]	24 4	44 2	125
Braniff	25 4	21 3	42 7	138
Penn-Central	23 [illegible]	12 3	35 0	303
WAE	20 2	25 0	44 1	150
Chi & South	20 0	25 4	45 0	311
Delta	16 2	26 [illegible]	42 3	088
Hanford	11 1	23 [illegible]	34 0	504
Boston-Maine	15 1	30 2	45 3	1 311
Continental	8 4	30 1	37 0	765
National A.T.	9 0	24 3	34 1	414

You can throw away all air mail maps that are more than a few days old Since last we went to press, the Post Office has (1) Awarded the Phoenix to Las Vegas route to TWA, (2) The Jacksonville to New Orleans route to National Airlines, (3) The Tempe to Memphis route to Eastern The Post Office has also advertised for bids on the much-battled-over Houston to Brownsville, Texas route; readvertized for bids on the Minot to Bismark route which recently drew no bidders, readvertized for bids on the Witchita to Pueblo route after throwing out all three recent bidders on technicalities It likewise sought and received ICC approval for Penn Central's bid for the Detroit to Sault Ste Marie route after throwing out another bid

Log Entries: The WPA announces it has spent $80,522,277 on 1,184 airport projects, as of March 1 The CWA and the FERA spent $24,000,000 on similar work The P.O has awarded United a fourth air mail schedule between Chicago and Salt Lake and TWA a fourth mail schedule between New York and Kansas City That should boost United's income $300,000; TWA's income about $150,000 per year without additional expenses to either American has plunked out some $50,000 for twelve new air conditioning units to keep their flagships nice and cool this summer no matter how long or hot the stop Three were tried out experimentally last year TWA's weather boys, headed by Ed Minser, played host last month to the American Meteorological Society,

meeting for a seminar at the University of Kansas City. Minser served as first vice-chairman, G. H. Parkinson, TWA meteorologist at K. C., as chairman of the program committee. . . United is going to town in a campaign to promote "vacation air travel". Its hitting Time and the Saturday Post and a number of newspapers with full page ads. Has put out a special booklet and is building fires under the travel agents. Featured are special all-expense expeditions to Colorado dude ranches, Yellowstone, Glacier, Yosemite, Boulder Dam and the Canyon, Mt Rainier, the Grand Tetons, etc.

AIRLINE INTERVIEWS

We met Lea Farrington, fittingly enough, in a Lockheed Zephyr ambling its way across the prairies east of Billings. For months reports had been drifting in about remarkable doings on the Northwest Airlines. It had been slashing fares, kicking the lid off cruising speeds with its new Lockheed 14's, and now it was hiring gals for its traffic department. We turned our seat and tangled our legs with the Farrington stilts. How come all this, we asked him, why couldn't Northwest behave like everybody else?

Farrington uncorked a thousand dollar laugh. Did we know *the* Northwest? No, not to speak of. . . Well, the reason Northwest was different was that *the* Northwest was different. The distances were huge. The people, most of them, were still pretty close to producing industries or agriculture. They didn't like fanciness. They knew what a dollar was worth and liked to get it for their money.

Northwest Airlines was a typical Northwest enterprise. Its Twin City backers thought of it as a real business. The great majority of Northwest employees were from *the* Northwest. A great deal of Northwest's traffic originated and ended in the tier of states between Wisconsin and Washington. . .

What did all this have to do with rates and speed and girls? Well hold onto that business angle. All Farrington claimed he had brought to his job was a feeling for what made good business sense and what didn't. . .

First, about those rate slashes. Just as a winter experiment a $15 round-trip fare had gone into effect between Chicago and the Twin Cities on Jan 1. For nine days, gross passenger revenue increased 500 per cent over the corresponding period of 1937. Over the whole system, similar rates boosted gross revenue 285 per cent. Then of course had come Northwest's first passenger fatalities and groundings of this and groundings of that. By the time the airline had been handed back to the Traffic Department, Spring was well along. But now a $23 round-trip fare between Chicago and the Twin Cities was cramming seven schedules a day and doing it so automatically that Farrington, for one, didn't credit the Traffic Department efforts one bit for it. Airplane fares right down on railroad levels were just good business. . .

And by the end of the year Northwest would be able to prove it. . .

Now those Lockheed —14's were simply business naturals for Northwest's set-up. The railroads between Chi and the Twin Cities were awfully hot competition. Recently they had been putting on streamlined Zephyrs and so on. The 14's let the air line restore its big time saving over that run. West of Minneapolis, the extra speed had let the line really allow enough time at stops and still eat up the big distances in good time. . .

And it made local stops practical, too. That was another thing Farrington favored. Once Northwest had cut stops at a small town from a six-a-day to two. Traffic out of that town fell off from about $15,000 a year to about $700. And not three passengers out of a hundred gave a damn for a few more short pauses. They were still beating the railroads about five or six to one. . .

The 14's big cargo space would help Northwest's mail and express. In the 10 A-s there just hadn't been room for all of it and the baggage too. Passengers liked the cabin roominess of the Zephyrs. The 10-A was all right but once Man Mountain Dean, the bearded wrestler, had retired into a 10-A lavatory and the plane had been held up at Twin Cities for twenty minutes until he could be pried out. . . Northwest certainly wasn't out to start any inter-airline speed war. . .

As for gals in the traffic office, why they made good business sense, that's all. Men in such jobs were apt soon to grow dissatisfied or lose interest under the routine. Yet gals could make a career out of it. Moreover, put one gal behind a traffic desk with three men and the customer will head for the gal every time—at least he will out in *the* Northwest. Farrington wasn't going to give up all his men either. As of mid-June there were 35 gals and 14 men in the traffic offices. Thirty-one other men also held down jobs in reservations and at the field offices. The downtown men he had were generally experienced traffic men, often from other fields. . . No he hadn't found any one formula for choosing the right girls, some were college, some ex-secretaries. Five had worked in department stores. One had been thirteen years in Butte's Finland Hotel behind the cigar counter. But they all had *worked* and they were all picked to get along with the people of *the* Northwest. . .

The lumberman across the aisle handed me the fifth cigar he had passed me since Seattle. The co-pilot came back to buckle us in for a Bismark landing. Everybody in the plane had been pulling for hours. As the plane came to a stop we all walked through the dark across a bit of *the* Northwest toward the lunchroom. The drummer from St. Paul had offered to stand us all to pie and coffee. Yes, maybe there was something different. . .

George Gardner, Western Division Superintendent for Northwest has been named General Operations Manager for that system to succeed Fred Whittemore, killed last month on a delivery flight. Gardner was formerly operations manager for Eastern and a C.A.C. inspector.

Lea Farrington is a big six-foot-seven Iowan who has been General Traffic Manager for Northwest Airlines for the past eighteen months. Before that he ran public relations for the Twin Cities Rapid Transit for ten years. Served two terms as president of the National Junior Chamber of Commerce. Helped draw up Wisconsin's liquor laws. Revived and still runs St. Paul's annual Winter Sports Carnival. Never in all his 34 years has he ever dreamed of being a pilot.

AS OTHERS FLY IT

A Birdseye-View of Aviation Abroad

England sinks bulldog teeth into arms program

Rearmament Scheme L is the latest one fished out of the file by the British cabinet to show Parliament Now that some of the smoke has cleared away you can begin to see the outlines of what looks like a definite plan with three main objectives . . . The one that got the most publicity was the decision to buy American ships for delivery within the next year or so This meant taking it on the chin and admitting that English factories weren't turning them out fast enough to satisfy requirements—something that the opposition had been trying to pin on the Government for months

The next part looks a little like the old political custom of solving a problem by putting a cabinet minister in charge of it. There has been a lot of shouting for a Ministry of Supply and the Government gave in enough to form a Supply Committee Under Scheme L they are supposed to get up an air force of around 3,600 first line planes by March 1940, but there are stories of a Scheme M still in the drawer that calls for this many in 1939 Anyway, the Supply Committee is shooting for increased production over 1937 of 50 per cent in 1938, and 200 per cent in 1939 This means that real quantity output from the shadow factories, which were supposed to be going full blast by now, isn't expected until next year Meanwhile some changes in procurement procedure designed to cut a lot of red tape are to be tried The cabinet shuffle resulted in signing up the prize holdout on the shadow factory scheme, Lord Nuffield, whose Morris auto works are the largest in England, but who had refused to play ball up to now. It's easy from over here to get the idea that all this could be done without any fuss in the U S, but a look at some of the contract figures released shows the English really have taken on a job—1,750 of one type divided among three companies, 1,500 of another from two, and 900 of a third from one firm Add these up and it's a lot of airplanes in anyone's industry The third part of the production picture is a little shadowy yet, but it's meant for the long pull and not for next year's planes It's the development of a Canadian aircraft industry big enough to carry a good share of the rearmament load come 1940 or so. The geographical and political setup looks fine —Canada's still a long trip from any probable enemy bases, and nobody's going to decide there's an official war going on and crack down with export restrictions Beside, spending airplane money in Canada would shut up some of the Buy-Britishers who frothed at the mouth when the American orders were placed. All that's needed to make a fine picture is a lot more industry —it's a long jump from last year's Canadian production of 118 planes to any number that would count nowadays. There's a good skeleton industry all ready for some meat—big companies like National Steel Car Co (Westlands) and Canadian Car and Foundry (Grummans) are building a few ships under license The latter have already turned some export business When you add on some British and American subsidiaries and some home grown factories you have a fair start.

There are stories that the shadow factory system is to be extended to Canada This scheme isn't as mysterious as it sounds—the government gets some manufacturer (in England they've mostly been auto companies) to put up and equip a plant with government dough, with a flat payment to cover management, etc, before production begins. When the airplanes (designed by an aircraft company) start coming out the manufacturer gets so much a ship (around $1,000 in England) with direct labor and material costs paid by the gov't To keep costs down he also gets about a 15 per cent cut on anything the gov't saves over the original estimated cost. If production stops, the factory is kept in working order at government expense. It all amounts to a sort of industry-managed, government-owned backstop to the regular aircraft industry

ROPE TRICK: 50 000 000 Frenchmen can't be wrong but some of them have queer ideas. Here one slides down a rope from a hovering auto gire just to thrill the crowd at a recent air meet at St. Germain.

British commercial aviation got a little attention from the new Air Ministry management too, mostly along the lines of the Cadman report (AVIATION May) The extra £1,500,000 subsidy was cut about two-thirds to Empire routes, one third to European. Part of the Cadman recommendations were thrown out the window by giving internal lines £100,000 to keep going. . . . K. L. M was granted rights to operate into Trinidad and Barbados in a swap allowing British lines through the Dutch West Indies Appointment of Sir Hubert Young as Governor of Trinidad is expected to shake up aviation down that way—as an administrator in Africa he did a lot to promote airlines . . . The British are bragging about the 212 tons of airmail in and out of Southampton in the first quarter of 1938, comparing it with the 307 tons of foreign airmail the U S handled in all 1937 They say when the surcharge comes off the mail to China Australia, and New Zealand they'll really begin hauling loads. . . . The All First Class Mail by Air move is spreading—England has taken it up on mail for Belgium and Switzerland and France has extended it to England, Germany, and Switzerland

The Atlantic picture doesn't look from European shores as rosy as it did earlier in the year—there's been an overproduction of ideas and announcements and an acute shortage of planes As things stand now the 1938 season won't be much of an advance on last year's survey flights. . . . The Pan American Imperial hookup expects to get under way in the fall with some real mail carrying, Imperial counting on some of the hopped-up Empire boats being out by then They have taken delivery on the Short Mayo combination, which survived tests of unhooking at full load and was sent back for new engines in the upstairs portion The English say Atlantic survey flights by it are due before long but there's muttering that the time and money spent proving that this pinch-hitter could be made to work might better have gone toward development of practical long range types along more conventional lines . . . Air France Transatlantique had a serious hangar crackup when their supercharged-cabin four-engined Farman 2230 landplane accidentally retracted its landing gear while on the ground after two test flights The French have gone in for flying model boat research, too—they've built a scaled down CAMS-161 with six 50 hp. engines as a move toward getting this 40 ton ship out

(Turn to page 71)

World's Largest Airliner uses 14 PESCO Products

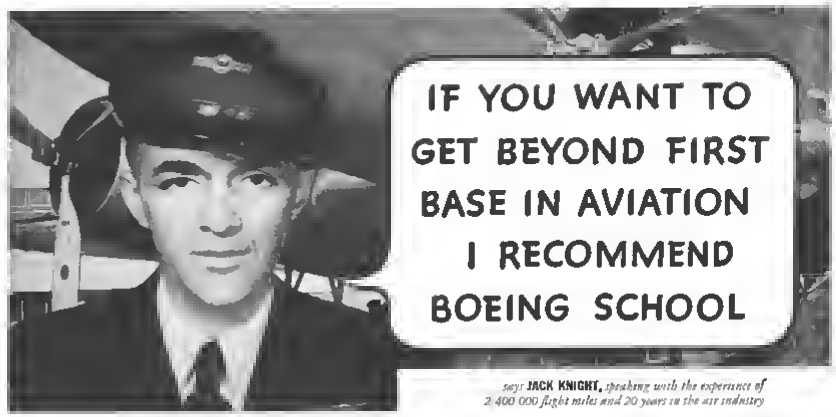
BOEING 314—Pan America's 74 passenger Transatlantic Clipper—marks an important milestone in Aviation History. The completion of this giant ship is a living testimonial to American engineering skill, and a notable achievement for Boeing Aircraft Co. and Pan American Airways. Pesco takes pride in the part it plays in this great achievement.

DOUGLAS DC4. Douglas specifies PESCO products for the DC4—America's largest commercial land plane. Of special interest are the new Tri-cycle landing gear and the Hydromatic Feathering propellers—activated by Pesco Hydraulic Pumps

PESCO Products on the BOEING 314 include—

- Engine-driven Fuel Pumps
- Engine-driven Vacuum Pumps
- Engine-driven Hydraulic Pumps
- Electric-motor-driven Fuel Pumps
- Electric-motor-driven Hydraulic Pumps for Hydromatic Feathering Propellers

PUMP ENGINEERING SERVICE CORPORATION 12910 TAFT AVENUE CLEVELAND • OHIO



says **JACK KNIGHT**, *speaking with the experience of 2,400,000 flight miles and 20 years in the air industry*

The most experienced air line in the world founded and maintains Boeing School of Aeronautics . . . to assure aviation a reliable source of trained young men—career men

From your very first day at this famous school, you realize that you are actually in aviation.

Your shops, laboratories and lecture rooms and the flight house are located right in the heart of aviation activities, the Pacific Coast terminus of United Air Lines. Your courses are directly under United supervision.

An average of only 8 students per instructor means you get to know your teachers intimately. And you rub shoulders with pilots, operations men, engineers, officials . . . have opportunity to meet men with years of experience in the field you're aiming at.

You graduate with the most comprehensive background of training that the nation's foremost air school can give you—fully equipped to carve yourself a worthwhile career in aviation. The outstanding record of 953 Boeing School-trained men throughout the world is your assurance of this.

• • •

1938 BOEING SCHOOL BULLETIN fully describes this school and each of 15 Pilot, Ground and Engineering career courses. Contains also vocational guide to opportunities, training requirements and lines of promotion in all fields of aviation. This 44-page book will be mailed to you promptly, without obligation. Fill out the coupon below.

Boeing School of Aeronautics
GRADUATION and PLACEMENT RECORD
(May 1937—April 1938)

Months	Number Graduated	Number Placements	No. Co. Employing Graduates
1937			
May	1	16	6
June	34	14	8
July	5	7	2
Aug.	4	2	2
Sept.	20	17	7
Oct.	4	5	2
Nov.	2	2	2
Dec.	29	7	3
1938			
Jan.	7	14	6
Feb.	1	9	7
Mar.	40	16	6
Apr.	6	13	3
TOTAL	153	120	29

Students in Air Transport Engineering and Pilot and Aeronautical Engineering courses in the design and drafting laboratory

Boeing School of Aeronautics

A division of UNITED AIR LINES

U. S. Government approved in ALL departments—Private and Commercial Flying, Mechanics Training and Repair Station

A COMPLETE RANGE OF 15 CAREER COURSES

There is one specially designed to provide a thorough foundation for success in your chosen field of aviation.

Check the course in courses you're most interested in

Courses requiring high school only
- ☐ Airline Pilot and Operations
- ☐ Commercial (or) L. C. Pilot
- ☐ Private (or) Solo Pilot
- ☐ Airline Operations
- ☐ Airline Mechanic
- ☐ Aircraft Sheet Metal

Courses requiring 2 yrs. pre-eng.
- ☐ Air Transport Engineering
- ☐ Practical Aeronautical Engineering
- ☐ Airline Flight Officer

Courses for engineering graduates only
- ☐ Airline Technician
- ☐ Dispatching and Meteorology

Courses requiring special training
- ☐ Special Airline Pilot
- ☐ Instrument Rating

NOTE: Link Trainer Instruction available to students in all courses.

Boeing School of Aeronautics
Dept. T-31, Airport,
Oakland, California.

GENTLEMEN: Please mail me—without charge—the 1938 BOEING SCHOOL BULLETIN containing complete information on the school and courses I have checked at the left.

Name _____

Address _____

City _____

State _____ Age _____

AVIATION'S

OPERATORS CORNER

Tagging the Bases with

LES NEHLLE

Steadham Acker, dynamic airport manager at Birmingham, Ala., is renewing his acquaintence with his family after months of night work putting over the Eighth Annual National Air Carnival. To say putting it over is putting it mildly because Master Showman Acker is never satisfied with turning out just another air show. Each one he runs is better than its predecessor and there are very few aerial expositions that approach this recent one in any respect. And the most amazing thing about the Birmingham carnival is that there is no admission or parking fee. Attendance on the second day was estimated at 150,000 persons. Local sponsors have their sales resistance mowed down by that same brand of Acker enthusiasm that prompts important people in the industry to lay aside weighty tasks and converge on Birmingham. If invitations from the Governor, the Mayor, and other prominent Alabamans do not move you, you are likely to be routed out of bed in the small hours of the morning and kept on the long distance 'phone until you agree to come. Steadham leaves no stones unturned. Sponsored by the live wire Birmingham Aero Club and by the city the annual event is the center of attraction for the citizenry. It is accompanied by a continuous round of social functions and elaborate entertainment for visitors. Climax of the festivities was the Aviation Ball at which Miss Dorothy Quackenbush (TWA) was selected "Miss American Aviation for 1938."

Air Minded Francis S. Murphy, general manager of the Gannett owned Hartford Times, awarded the trophy sponsored by his paper to Robert D. W. Vroom of Wallingford, winner of the Connecticut Aviation Club's Sky Cruise. Flying his Waco at 125 m.p.h., Vroom hit his estimated time of 38 minutes from Providence to Hartford squarely on the nose. Second honors went to C. A. Moeller, New Haven, flying an Aeronca and missing by four seconds. Third to Peter Mikkelsen, Wilson, flying a Waco and missing by six seconds. Timers were State Commissioner C. L. Morris, who worked out the details of the race, and City Commissioners John B. O'Neil and Medes Pelshaw.

PROMOTER. Steadham Acker, caught in the act of explaining how something should be done.

BEAUTY: Dorothy Quackenbush, of TWA, carried off first honors in the contest held at the Birmingham Air Carnival.

Photos by AVIATION

LAW LAUGHS: Wiley Wright, Bureau regional inspector in the South east, was pleased with the smooth running of the Birmingham Show

AIR LINE BOYS. Leigh Parker, of Delta (left) and D. D. Walker, of Chicago & Southern, were among the airline representatives who went to Birmingham.

First meeting of the new Board of Directors of Non-Scheduled Aviation, Inc., was held in Los Angeles, May 26th, under the chairmanship of K. C. Hawkins. Originally formed as the "Independent Owners and Operators Association," it was decided that for brevity and clarity the shorter and more concise name "Non-Scheduled Aviation, Inc." should be adopted. Articles of incorporation under this name have been filed with the California Corporation Commissioner by Mr. Bertrand Rhine, attorney and director on the board of this non-profit corporation association. Membership applications have been printed and members are now being enrolled, dues being $1 per year for associate members and $5 per year for active members.

The Licensed Airmen of America, operating as a chapter of the N.A.A. with headquarters at the Plaza Hotel, Hollywood, reports a rapidly growing membership, largely as a result of the present move to organize non-scheduled aviation interests. The Licensed Airmen of America welcome all licensed aviation personnel into their ranks. Monthly educational meetings are held. Close liaison with the Bureau of Air Commerce is maintained, to receive the latest information, and to make suggestions concerning regulations.

Cub Non-Stop Flight

Newark-Miami and Return With Mid-Air Refueling

FLYING A LIGHT PLANE non-stop from Newark to Miami and return sounds like a "believe-it-or-not" but it has been done. The secret of success was midair refueling at Raleigh, Jacksonville, and Miami. Two new light-plane records were set in the process.

The ship was a stock model Piper Cub Sport with a 24 gallon belly tank and a 10-gallon reserve in the luggage compartment, bringing the fuel capacity up to 43 gallons. Engine was the 50 hp. three cylinder, dual ignition Lenape Papoose. Pilots were Kenneth Kress and Glenn Englert, Piper test pilots.

Take-off was at 4.06 A.M., May 17 and landing was at 8.00 P.M. May 19, with two nights passed circling the Jacksonville Airport waiting for better weather. Radio information was furnished through the cooperation of Eastern Airlines and the Weather Bureau and a Lear receiver was used.

ON THE NOSE. Pilot Robert D. W. Vroom accepts the Hartford Times Trophy from General Manager Francis S. Murphy. Vroom won the Connecticut Aviation Club's Sky Cruise by estimating his flying time exactly between Providence and Hartford.

Accident Report

Beech Corrects Erroneous Newspaper Accounts

ONE OF THE MOST UNFORTUNATE PROBLEMS the industry has always faced is the readiness with which some newspaper men accept the colored accounts of eyewitnesses of airplane accidents. All too frequently these impressions get into print and the public is misled.

In an effort to correct the impressions produced by the erroneous reports of certain wire services in a recent accident, the Beech Aircraft Corporation has issued a statement to all Beechcraft owners, in advance of the report of the Department of Commerce. We wish to commend Beech for this action and to urge other manufacturers to do likewise. It is our hope that the true facts surrounding all aircraft accidents be circulated as promptly and as widely as possible.

EXECUTIVE: Carl Westten, who has sold both Cubs and Taylorcraft, is now vice-president (sales) and a director of Aeronca. His ambition is to push sales far beyond this year's quota.

FISHING FOR FUEL: This method of refueling was used by Pilots Kress and Englert in their recent non-stop flight from Newark to Miami and return in a Piper Cub.

U.S.A.I.G. Birthday

Insurance Company Celebrates Tenth Anniversary

DAVE BEERE and Reed Chambers, president and vice-president respectively of the United States Aviation Underwriters, are celebrating their tenth anniversary on July 1. The founded the company and organized the correlative U. S. Aviation Insurance Group in 1928.

D of C Asks Fields

Program for Eight Southern States Totals $44,494,450

IMPROVED AND INCREASED AIRPORT FACILITIES in eight southeastern states will cost a total of $44,494,450, if the recommendation of the Airport Section of the Department of Air Commerce is approved. Figures for the eight states, and the recommendations, were presented by Maj. A. B. McMullen, chief of the airport section, during an organization meeting of the Southeastern Aviation Conference held in Montgomery, Ala., recently. States effected by the proposal are Alabama, which would receive $5,797,760; Florida, receiving $5,676,300; Georgia, $8,322,100; Kentucky, $5,604,200; Louisiana, $4,968,100; Mississippi, $4,504,900; South Carolina, $4,767,600; and Tennessee, $4,670,900.

REPORT CARO

Of Air School Developments

Anticipating wider use of stainless steel in the aircraft industry, the Curtiss-Wright Technical Institute of Aeronautics, Glendale, Calif., is adding a regular course in the fabricating of stainless steel. F. R. Shanley, chief engineer of the Curtis-Wright school, points to the present increasing use of stainless steel in aircraft, and to the particular characteristics of the metal which makes it desirable for use in the construction of large flying boats, as justification for intensive training in stainless steel manufacturing technique at this time.

Most recent addition to the Parks Air College training fleet is a new Dart Model G powered by the 90-hp. Lambert engine. The order was placed after some 35 hours of test flying by students and instructors at the school. This purchase brings the number of airplanes in the Parks fleet up to 13.

Latest additions to the curriculum of the Ryan School of Aeronautics, San Diego, is the Master Pilot's Course especially planned to provide the advanced instruction which is becoming increasingly necessary for pilots entering the commercial field. Besides the 176 hours of flight training and three months of ground school included in the regular Commercial Pilot's course, the course provides 50 hours of additional flying, two months of Advanced Navigation and six months of Master Radio. Exceeding requirments for the Instrument Rating, the Ryan Master Pilot's course gives 25 hours of actual instrument and blind flying instruction. In fact, 10 hours of blind flying are included in the Commercial Course, even though not required for that grade of license. Navigation and Radio instruction are under the direction of Lt. Comdr. Lloyd R. Gray, U. S. N., ret.

Aero Industries Technical Institute has added a one year Aeronautical Engineering Course to the Master Aircraft Mechanics Course. The former is conducted under the supervision of John K. Northrop, eminent engineer and designer, who in addition is a member of the Institute's Executive Board.

The new Aeronautical Engineering Course was laid out by the Executive Board (consisting of John K. Northrop; C. A. Van Dusen, of Consolidated, and Robert A. Gross of Lockheed) to fill a specific need in the industry for designers and draftsmen who have had practical experience combined with their theoretical training.

AS OTHERS FLY IT

(Continued from page 64)

The other two big transatlantic boats, the Latecoere 631 and the S.E. 200, aren't expected for about two years. They will gross about 65 tons (wing loadings will run about 42 lb.) and will have such gadgets as retractable wing floats and a retractable step if one can be doped out in time. . . . The Germans have not yet promised anything sensational for the North Atlantic this year—more catapulted survey flights look to be on the books. They've moved one of the Ha 139 seaplanes used on last summer's survey flights to the South Atlantic mail run. . . . The Italian South Atlantic line will be run with three-engined CANT Z 509s, developed from the Z 506 that made the survey flight. They are low wing float seaplanes cruising well over 200 mph. Since a lot more wood than aluminum grows in Italy, they have wooden wing and fuselage structures with plywood covering.

Upward and onward with helicopters has some reputable designers in Europe pretty enthused. They all get very insulted when anyone hints that the progress from the flightless vertical-flight contraptions of a few years ago came mostly from looking at autogiros. The two prize machines now flying, the German Focke-Achgelis and the French Bregnet-Dorand, both have rotor blades flexibly attached, and pitch control on the blades. If the engine quits they come down at safe speeds by autorotation. Rotor arrangement is different—the Focke-Achgelis has one on each side carried on outriggers, while the Breguet-Dorand has an oppositely-rotating pair one above the other, with a device to keep the two rotors from tangling up . . . . Present performance isn't very hot as far as forward speed goes, but all the designers claim that the type has inherent possibilities of beating conventional airplanes.

AIR TOURISTS. Participants in the Second N.A.A. Air Tour resting at Shreveport, La.

Aircraft Armament

(Continued from page 23)

Total piston rod pull 455 kgs (1000 lb.)
Elevation —15° to plus 60°
Traverse 360°
Cadence of fire 150 shots per minute
Weight of gun with mount and turret ready for installation 1136 kgs (250 lb.)
Recoil mechanism Hydraulic Spring System

Ballistics

Weight of high explosive shell 0,5 kgs (1.1 lb.)
Weight of complete round 0,636 kgs. (1.4 lb.)
Weight of powder charge 24,3 grams (375 grains)
Weight of clip with 5 rds of amm 3,8 kgs (8.2 lb.)
Muzzle Velocity 881 mps (1250 fps)

Specifications of AAC 37 mm Aircraft Gun Type F

Calibre 37 mm (1.457 in.)
Length of gun in calibres 50
Muzzle Velocity 823 m/s (2700 f/s)
Weight of projectiles 0.50 kilos (1.1 lb.)
Weight of complete rd. of amm. 0,78 kilos (1.72 lb.)
Length of recoil 381 mm (15 inches)
Recoil pull 771 kilos (1700 lb.)
Weight of gun without supports 199.5 kilos (440 lb.)
Maximum rate of fire 100 shots per minute
Overall length of gun, incl length of recoil 2.54 meters (100 in.)
Maximum height of gun bottom of cradle to top of ammunition hopper 0.432 meters (17 in.)
Maximum breadth of gun 0.228 meters (9 in.)

This gun in Type M (Fig 5) is mounted in the nose or in the rear of the airplane fuselage. The cannon is traversed by means of gearing operated by a hand wheel actuated by the gunner's right hand while elevation is done with the left hand operating another control wheel The gun is fired with the left foot, the right foot operating a traversing brake The gunner is seated facing the gun and sights through a right angle sight—the eye piece being located on the left trunnion of the gun and remains fixed with respect to the gunner's eye—regardless of the position of the gun The sight has a wide angle of vision and a magnification of two It is equipped with a series of cross hairs for laying the gun for range and speed. The type F gun is similar to the type M being slightly longer in length It is an excellent offensive weapon.

The Madsen 20–23 mm machine gun cannon (Fig 6 and 7) is an air cooled, full automatic gun actuated by the explosive gases and a system of springs The gun fires an explosive shell which has a high destructive effect At ranges of 2,000 feet the trajectory of the 23 mm shell is flat which increases the effectiveness of the weapon for encounters at high speeds By using flexible belts for carrying the ammunition the weapon will fire incessantly for as long as shells are available—firing at the rate of 20 shells per second The gun is fairly light and can be used as a fixed or flexible installation It is a direct fire weapon.

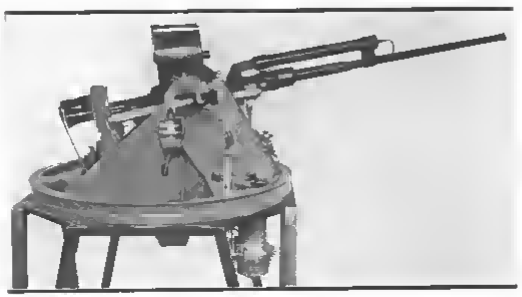
Data for Madsen 23 mm Automatic Gun

Length of the gun with muzzle brake 2000 mm
Length of the barrel 1200 mm
Number of grooves 12
Twist of grooves 36 cal
Depth of grooves 0.2 mm
Width of grooves 4 mm
Force of recoil by automatic firing 180 kg
Force of recoil by single shot 150 kg
Weight of gun 52 kg
Rate of fire 360/400 rounds/min.
Weight of cartridge 0.340 kg
Weight of cartridge link 0.035 kg
Weight of explosive shell (E.S.) 0.173 kg
Weight of explosive charge 0.017 kg
Initial velocity abont 675 m/sec.

Projectiles for the A A C. gun are loaded with cast T N T, that of the Madsen with nitro-cellulose Both shells carry a supersensitive quick acting fuse which fires the shell automatically if no hit is made The A A.C fuse is "bore safe" and "detonator safe" preventing premature explosion of the shell in the gun barrel or by careless handling Since both guns are direct fire weapons projectiles are equipped with tracers which are visible by day or night.

For offensive purposes, the plane should also be equipped with small bombs or aerial grenades which it should be capable of projecting upon enemy aircraft in much the same manner as the grenade from a trench mortar Experiments with salvo-bombing have been tried in this country and abroad and is looked upon with great favour by European powers Bombing operations upon enemy aircraft are very effective providing the combat plane can rise above the enemy rapidly and retain this position. The former can then drop an "aerial depth bomb" upon the lower airplane. If a combat plane is provided with a small bomb bay either in the fuselage, or just outboard in the wing to carry small aerial grenades its striking power and strategic value is enhanced.

Proposals have been made from time to time on "aerial torpedoes", that is, a plane built for the express purpose of flying it into enemy bombers,—destroying both the bomber and the torpedo airplane The pilot of such plane is to fly his plane on a straight course into the bomber, leaving by parachute just before collision Besides being a haphazard method of attack, it is indeed a very costly one. It necessitates the recruiting of 'suicide squads" since there is good reason to believe that a pilot may not get clear in time, or will be attacked by enemy gunners while descending by parachute



Type FFS 20 mm. aircraft gun on Model AB-5 mount by Werkzeug Maschinenfabrik-Oerlikon (Switzerland) Electro-hydro-pneumatic control. 470 rounds per min. at 2820 f.p.s. muzzle vel. (Courtesy INTERAVIA)

Compact Maintenance

(Continued from page 28)

a height that it is easily worked on from floor level The propellers can be rotated for checking valve clearances by removing a board cover from a narrow pit in the floor

Our engine shop is divided into two sections, one for the overhaul of the engine and nacelle, and the other for all engine accessories

Quite a novel dolly was designed in the engine shop for handling these engine nacelles while they are being assembled, disassembled or in storage after run in This dolly consists of a horizontal oblong frame mounted on four casters so that it is easily moved To this horizontal frame is mounted a vertical frame on which are four lugs, spaced the same as the Lord mounts on the airplane firewall, to which the nacelle is fastened with pins. The vertical frame is hinged just above the horizontal frame, and can be folded so that the nacelle and engine crankshaft can be set in a vertical position. This nacelle dolly is universal, and has many uses For example, when an engine nacelle is removed from the airplane for overhaul it is attached to the nacelle dolly with the attaching frame vertical, and nacelle in a normal position After being wheeled into the engine shop the oil tank and lines, and all rear mounted engine accessories are removed The mounting frame is then hinged back so that the nacelle and engine crankshaft are vertical. In this position the engine is completely disassembled, the parts being placed on movable racks and sent to the cleaning department.

The nacelle mount is left attached to the dolly and all necessary repairs made. With the nacelle mount still in the same position as when the engine was disassembled it is ready for the installation of a freshly overhauled engine. The overhauled engine to be installed is lifted from its assembly stand by a hoisting eye screwed to the nose of the crankshaft. The engine assembly stand is rolled away and the dolly with nacelle mount wheeled beneath the suspended engine. It is then lowered into and attached to the mount ring While in this position the exhaust stack and all air induction tubes are installed, and then the nacelle mount is hinged back to its normal position with mounting frame vertical, and crankshaft horizontal All rear accessories and oil tank plumbing are now intalled The nacelle is then wheeled out and removed from its dolly and installed on the test stand for run in After being run in, it is removed from the test stand and again attached to the nacelle dolly and placed in storage until it is needed for installation

The test stand on which the engine nacelles are mounted for run in has a fire wall equipped with Lord mounts, Cannon plugs and controls, just the same as the fire wall on the airplane It is also equipped with battery, generator control box, standard set of engine instruments and controls, so that the operator has complete control and check on the operation of the engine while it is being run in. Necessary graduated tanks are installed in order to get correct reading on fuel consumption It is on wheels, and is towed out well away from the shop and offices, so that the noise is never objectionable

While operating older equipment previous to the purchase of our present Electras, it was the thought of the men in our instrument shop that it would be possible to eliminate failures and also get better service out of the flight instruments if they were checked for calibration at closer regular intervals With this thought in mind when our Electras were ordered from Lockheed, we had them group the flight instruments on a separate panel in the center and attached directly to the main panel All connections to these instruments in the back of the panel are grouped in such a way that they are easily connected or disconnected The instrument department keeps a spare flight panel in stock, serviced and ready to use.

At every regular 80 hour check, the flight panel is removed and the spare panel installed The removed panel is taken to the instrument shop and all instruments checked for calibration. If found out of calibration or any strange noises are noticed in the gyro instruments, they are removed from the panel for overhaul, and are replaced by spare instruments held in stock The serviced flight panel is then returned to stock, ready for installation in the next airplane when it comes in for its regular service check.

In case of reported inaccuracy of any instrument in the flight group while a ship is making a regular flight, the spare panel is installed in the airplane when it makes its regular stop at St. Louis It is possible with this installation, as it is made, for two men to exchange flight panels in ten minutes and the airplane continues its regular flight on schedule without a mechanical delay

Crankless Engine

(Continued from page 39)

per square inch pressure in the four cycle execution During the tests, oil consumption as low as 015 was obtained in spite of several oil leakages which will be remedied in a second design

It is believed that the weight of power plants of this design will not exceed 70-75 per cent of conventional radial engines of the same power, and thus far evidence has been obtained to fully substantiate this statement These figures will include radiator and cooling liquid in the liquid-cooled executions

Measurements were also made of the heat rejected through the cooling jackets resulting in readings equivalent to 40 per cent of the brake horsepower This is unconventionally low and is approximately ½ of the rejection observed in engines of the four stroke cycle variety.

The reasons for the low weight of these engine designs lie in the compactness the great specific output, and the lack of a great number of highly stressed moving parts Its low heat rejection is responsible in part for the low fuel consumption obtained and for the small size required for a radiator when liquid-cooled.

In this development great credit must be given to the staff of the Engine Laboratory of the Massachusetts Institute of Technology and particularly to Professors C. F and E S Taylor in charge of that Department. Designs were prepared under their guidance and their assistance is considered one of the main factors in the success of this development.

Hydromatic Propeller

(*Continued from page 29*)

board side in the dome G, through ports K and J, into the oil supply pipe D, and back into the engine lubricating system. As the piston moves out, the blades move to a higher pitch, and the motion is finally stopped by the rotating cam coming against an adjustable mechanical stop (not shown in the sketch) set for the fully feathered position of the particular blade design being used. With all motion stopped and the feathering pump still functioning, the feathering oil pressure builds up until it reaches 400 pounds per square inch, at which point a pressure cut-out switch opens the electrical circuit operating the pump by de-energizing the solenoid holding the cockpit solenoid switch in. With the blades feathered, engine rotation is stopped and consequently the blade centrifugal twisting moment and engine oil pressure have dropped to zero, and the blades remain in the feathered position. The feathering takes an average of 9 seconds.

To unfeather the blades, the pump is again started and permitted to build up a pressure greater than 400 lb. per sq.in., simply by physically holding the cockpit solenoid switch closed (see Fig. 2). At approximately 500 to 600 lb. per sq.in. pressure the force at Q at the base of the distributor valve in the propeller is great enough to force the distributor valve out compressing spring R and the valve moves toward the position shown in the bottom view of Fig. 1, disconnecting the engine oil system from the dome. The oil from the pump starts to fill up the dome on the outboard side of the piston through ports S and K as the distributor valve moves out, and this oil starts pushing the piston in, unfeathering the blades. The oil on the inboard side of the piston is forced through F and J into the engine.

The unfeathered propeller in an airplane moving through the air starts to windmill. When the engine reaches a reasonable r.p.m., the cockpit solenoid switch is released by the pilot. The propeller continues to windmill, cranking the engine, and it is thus possible to start the engine running again. The moment the feathering pump stops, the spring in the cut-out valve in the governor disconnects the feathering pump line from the propeller and places the governor back into the system, and the propeller runs again at the speed for which the governor is set by the pilot in the cockpit.

The Hydromatic propeller during normal constant speed operation requires two simultaneous sources of oil supply, one being oil from the constant speed control booster pump and the other being oil under normal pressure from the engine oil system. Referring to Fig. 1, oil from the constant speed control pump A is permitted to enter the hollow drive gear shaft B of the governor and thence to the propeller shaft when the engine is turning faster than the speed for which the governor is set by the pilot in the cockpit. Governor oil is thus metered at the top port of the drive gear shaft, and enters the rotating propeller shaft by means of the oil transfer rings C. It then follows the same path described above, for the oil during the feathering operation, to the inboard side of the piston.

AT THE SAME TIME, oil from the engine lubricating system under normal engine oil pressure enters the propeller mechanism through the supply pipe D in the center of the propeller shaft and reaches the outboard side of the piston through ports J and K.

The governor oil pressure builds up until it exerts a force greater than the sum of the forces which oppose motion of the piston outward into the front of the dome. These forces are:

1. Engine oil pressure times the effective piston area.
2. The net blade twisting force consisting of the blade centrifugal twisting moment modified by the aerodynamic twisting moment.
3. Friction of the moving parts of the propeller mechanism.

The net blade twisting force is transmitted from the blade gear segment L to the rotating cam M and through the cam rollers N acting in the slots of the rotating cam, to the piston.

The blade centrifugal twisting moment is a moment acting on the propeller blade around its longitudinal axis in the direction of a decrease of blade angle. It is the result of a force couple consisting of the resultants of components of centrifugal force acting on the mass of the propeller blade on either side of the blade's longitudinal axis. The aerodynamic twisting moment is usually opposite in direction to the blade centrifugal twisting moment, being caused by the position of the resultant center of pressure of the airfoil section of the blade in front of the center of rotation of the blade (the blade's longitudinal axis). In normal level flight this aerodynamic moment is relatively small in magnitude.

When the governor oil pressure builds up to a value of force on the piston just greater than the sum of these three forces, the piston starts to move out toward the front of the dome, and engine oil in front of the piston is displaced back into the engine lubricating system. This outward movement of the rotating cam increases the pitch of the blades and the engine speed is thus slowed down. As the engine slows down to the speed for which the constant speed control is set, the pilot valve in the governor descends to the position shown in the top section view of the governor in Fig. 1, thus shutting off the top port of the drive gear shaft and cutting off the supply of governor oil from the booster pump to the propeller. The oil under pressure from this pump, of course, then goes through the relief valve back to the engine, and the propeller runs on speed.

Should the engine r.p.m. fall below the speed for which the governor is set, the pilot valve in the governor descends still further, opening the bottom of the drive gear shaft to drain. Engine oil in the dome at the outboard side of the piston is always, during normal propeller operation, under pressure from the action of the engine oil pump. This pressure acts as if a spring were placed between the outer end of the piston and the front of the dome, the spring, however, having the unusual characteristic of exerting a constant force regardless of the amount of its compression. The blade centrifugal twisting moment, aided by this "spring" force, moves the piston inward overcoming friction and the back pressure existing in pushing governor oil back through the governor to drain. As the pitch of the blades thus decreases the engine speed picks up and the pilot valve in the governor is raised, closing off the drain through the drive gear shaft just as the engine reaches the speed for which the governor is set.

It should be noted that the relief valve in the governor is so interconnected with the engine oil system that the relief valve is held closed by the force of the relief valve spring plus the engine oil pressure force on the relief valve, whatever this may be. Thus, the effect is to provide a maximum pressure differential across the propeller piston equal to the relief valve spring setting, and the effects on the operation of the propeller of variations in engine oil pressure in any one engine or between engine types are eliminated.

WELDWOOD
RESIN-BONDED
AIRCRAFT PLYWOOD

The cabins of this great DC-4 plane as well as those of the 74-passenger Boeing-Clipper are finished with "USP" FLEXWOOD — thin veneers mounted on fabric for almost weightless interiors. The fuselage nose of the DC-4 is constructed of WELDWOOD.

• • • MADE WITH A KEEN SENSE OF RESPONSIBILITY

WELDWOOD AIRCRAFT PLYWOOD is manufactured at our Algoma, Wis. plant by an organization with more than 50 years experience in the production of fine plywood.

Our skilled craftsmen have handed down their priceless experience from father to son since the very beginning of the aircraft industry in the United States. This knowledge, coupled with the scientific control of modern precision machinery, yields an unassailable technical product in a field where reliability is of first importance.

WELDWOOD is manufactured from log to finished product by one organization employing skilled northern workmen, every step in production under direct, unified control.

WELDWOOD is available in hollow-core, light-weight construction, ARMORPLY (metal-covered panels), flat sheets in any size, thickness or construction and in sheets curved or formed to specifications.

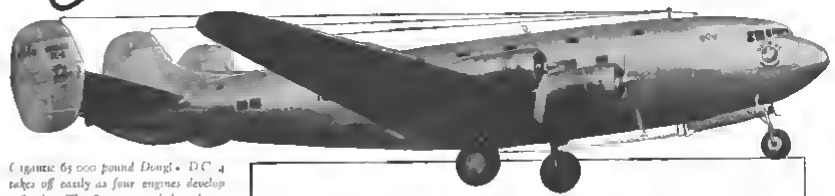
UNITED STATES PLYWOOD CORPORATION

EXECUTIVE OFFICES: 616 West 46th Street, New York, N. Y.

MILLS: Algoma, Wis. • Birchwood, Wis. • Seattle, Wash. • Orangeburg, S. C.

BRANCH OFFICES AND WAREHOUSES: Baltimore • Boston • Brooklyn • Chicago • Cincinnati • Cleveland • Detroit • Los Angeles Newark • New York • Philadelphia • Rochester • San Francisco • Seattle

World's wonder ship...



Gigantic 65 000 pound Douglas DC-4 takes off easily as four engines develop 5,600 h.p. This $1 500 000 skyliner has a pressure cabin for stratosphere flying and every convenience for passenger comfort.

EQUIPPED WITH MACWHYTE "Hi-Fatigue" AIRCRAFT CABLES

A milestone in the history of heavier than air craft is the new Douglas DC-4! Today the aviation industry and its suppliers salute this new giant ship. It combines speed, safety, and comfort in flying undreamed of a few years ago.

"HI-FATIGUE" CABLE ON CONTROLS

The Macwhyte Company is proud of the part their cable plays in the everyday operation of this new sky liner. Connecting the all-important controls are Macwhyte Hi-Fatigue Cables. As modern, as reliable, and as smooth in operation as the ship itself.

More manufacturers and airlines today are using Macwhyte "Hi-Fatigue" Cable and Tie Rods than ever before. They must be *sure* of the equipment they buy, that's why they choose Macwhyte.

MACWHYTE AIRCRAFT CABLES

Macwhyte Hi-Fatigue Aircraft Cable is available in both PREformed and Non preformed—tinned galvanized or stainless steel

MACWHYTE TIE RODS — Streamline ■ Square ● Round

Macwhyte Tie Rods like Macwhyte Aircraft Cables, conform to all A-N specifications.

MACWHYTE COMPANY

KENOSHA, WISCONSIN

Specialists in the manufacture of Cable Tie Rods and Braided Wire Rope Slings for aircraft

No. 394

MACWHYTE Hi-Fatigue AIRCRAFT CABLES

TRADE MARK

Through these portals pass future manpower for the aircraft industry—men first carefully selected, and then equipped with a superior training...so that they may enter the industry as competent craftsmen and engineers.

EXECUTIVE BOARD

JOHN K. NORTHROP
Formerly—President, The Northrop Corporation; Vice-President, Douglas Aircraft Company, Inc.

C. A. VAN DUSEN
Vice-President, Consolidated Aircraft Corporation

ROBERT E. GROSS
President, Lockheed Aircraft Corporation

The Executive Board directly supervises the policies, management, and operation of this institution.

ENTRANCE REQUIREMENTS—LIMITED ENROLLMENT
Descriptive Literature on Courses Available

AERO INDUSTRIES TECHNICAL INSTITUTE

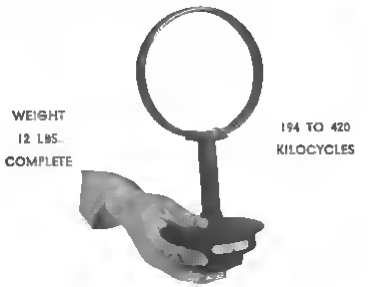
5261 WEST SAN FERNANDO ROAD, LOS ANGELES, CALIFORNIA

AIRCRAFT RADIO BEACON-COMPASS RECEIVER

FLIGHT INSTRUMENT

MODEL CB-3

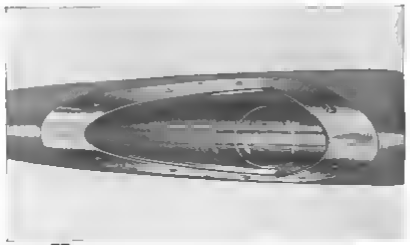
SEALED AND GUARANTEED FOR ONE YEAR



Write for Bulletin

Makers of Aircraft Radio for the Past Ten Years

RADIO FREQUENCY LABORATORIES, INC.
BOONTON, N. J.



The new Pyle-National interior wing position light is standard equipment on the Douglas DC-4. This light is installed flush with the wing surfaces, and uses a 12 volt 100 c p lamp bulb.

The landing lights and position lights on the Boeing Clipper are also supplied by Pyle-National.

The PYLE-NATIONAL COMPANY
1334-58 North Kostner Avenue, Chicago, Ill.

THE GIANT BOEING CLIPPER 314

IS EQUIPPED WITH "NORMA-HOFFMANN" PRECISION BEARINGS

*The NORMA-HOFFMANN line of 108 distinct series and over 3000 sizes affords PRECISION BEARINGS of time-tested reliability—for engines (including superchargers), engine accessories, control apparatus, instruments, radio equipment, cameras, and landing field equipment * * * * Write for the Catalog. Let our engineers work with you*

This 41-ton giant of the air—the largest airplane ever built for any of the world's airways—marks another milestone in aviation progress. Built for trans-oceanic passenger service, it naturally incorporates all that has been proved dependable in aviation's past experience. * * * * Therefore, as would be expected—based upon performance records—NORMA-HOFFMANN PRECISION BEARINGS are used at many vital points throughout the ship—in the controls, and in the Sperry, Pioneer and Kollsman instruments. * * * * *"Where the bearings must not fail"*—on land, at sea, and in the air—NORMA-HOFFMANN is the choice of engineers, designers, builders and owners.

NORMA-HOFFMANN BEARINGS CORPN., STAMFORD, CONN. U.S.A.

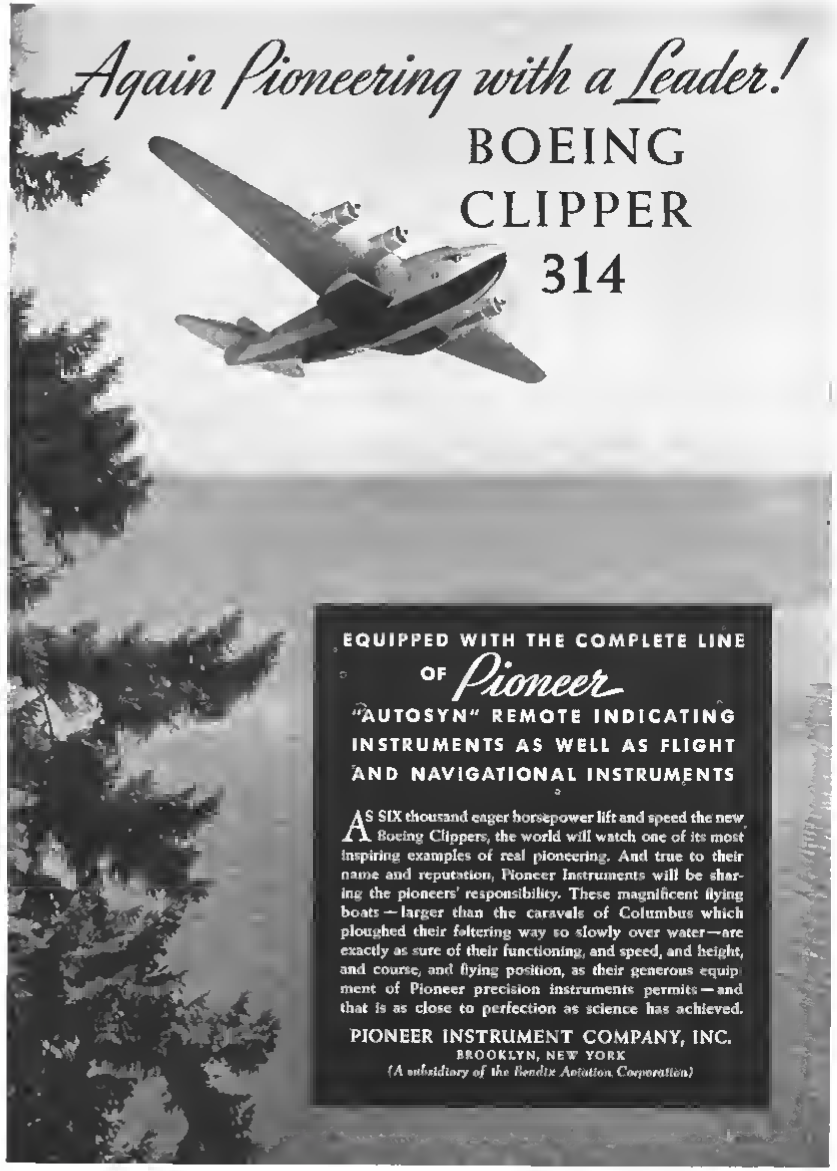
In 1910, flying over a city in an airplane came under the heading of "Hazardous." It was believed that heated air currents from the streets might cause disaster.

But Robert Latham, a Frenchman, quelled all doubts by soaring over the city of Baltimore, Md., for almost an hour on November 7, 1910, and captured the prize of $5,000 offered by the Baltimore Sun.

Thus was disproved the "city hot air" theory, and today airmail and passenger planes fly over every city in the country.

From the time the Wright brothers, with a small gasoline engine, furnished an effective power-weight ratio, engineers concentrated on improving engines and fuels so that aviation could continue to do the "things that couldn't be done."

But the job is not finished. It may never be, because research admits no limits. Ethyl engineers are working continuously with aviation engineers in the development of fuels and engines that will play a major part in establishing new world records that are to come. Ethyl Gasoline Corporation, Chrysler Building, New York, New York.



Do you know that . . .

each month our subscription department receives more than 150 requests for "back" issues of AVIATION.

❖ ❖ ❖

If we printed extra copies of our monthly issues, we would be glad to comply with these requests, but unfortunately we have no way of knowing in advance just how many of our newsstand readers will "miss" an issue.

❖ ❖ ❖

But We Do Know—that each of these requests indicates a reader has "missed" just the issue he could make valued use of.

Insure your receiving AVIATION *regularly by filling in the coupon below, today . . .*

AVIATION
330 W. 42d St. New York City
Enclosed is my check for $5.00 Send me Aviation for one full year.

Name .....
Address .....
City and State .....
Nature of Activity .....

SUBSCRIPTION RATES:
United States Mexico and Central and South American countries $5 a year; Canada (including duty) $5.50 a year; All other countries $6 a year or 30 shillings. Member of A.B.C.

INDEX OF

AVIATION "Classified" for July, 1938

PLANES ENGINES PARTS FOR SALE

Planes General 42 47 64 85
Planes, by Make:
Aeronca 14 35 41
American Eagle 8
Arrow 46
Avian 8 21
Caproni 39
Eastman 20a
Fairchild 18 28 32 36 47e
Fleet 25 47f
Franklin 14 22
Junior 11
Kellet 4
Kinner 31
Lockheed 47a
Monocoupe 15a 66
Rearwin 10 12 66 18
Robin 5 26 34, 47c
Ryan 24
Savoia Marchetti 1 12a
Sikorsky 21 30
Stinson 2 33 44 45 61 66 78 33a
Swallow 16
Taylor 3 7 17 70 43 47b
Trade 47d
Travelair 6
Vultee Transport 65
Waco 8 15 29 38 61
Engines and Parts 12 19 19 16 46 67 67, 68 69 73 70 77 88
Plane Parts 6 66 47 69 77 84

PRODUCTS:
See Classification and/or Numbers as follows
Accessories and Supplies 58 66 87
Books 48 48 65 60a 67 81
Catalogs 42 57 76
Dope 78
Fuses 67
Hangars, Portable 64
Instruments 65a 71 77
Materials 66
Office Equipment 57
Parachutes 62 51a
Pontoons 52a
Propellers 17 80
Wheels 84

SERVICES:
See Classification and/or Numbers as follows
Charter 61 63
Flying Instruction 7 62, 63 75
Ground Instruction 65 68 86
Repairing 63 68 72 77
Sales 52 59 60 77
Schools 7 60 65 62a 68, 69 71 75 83 86 94 97 108 7
Storage 63
Stunt Flying 74

FOR RENT:
See Numbers as follows 54 55

TRADE:
See Numbers as follows 1 12a 26 35 67 39 42 33a

WANTED
See Classification and/or Numbers 58

POSITIONS VACANT
See Classification

POSITIONS WANTED:
See Classification

REPRESENTATIVE AVAILABLE
See Classification

BUSINESS OPPORTUNITIES

SAVOIA MARCHETTI 125 Kinner ship and engine first class shape $1 300.00 cash Trades accepted Meinke Eldred Flying Service, Lost Nation Airport, Willoughby, Ohio No 1

LATE '37 DELUXE GULL WING STINSON Lycoming 245 Automatic rocker arm lubrication Positively like new 160 hours since leaving factory Never scratched or cracked In addition to standard equipment R C A receiver extra head-sets Lear 30 watt transmitter, both winding and fixed transmitting antennas Pioneer and Kollsman sensitive altimeters flight clock, rate of climb, bank and turn gyro compass artificial horizon, thermocouple head temperature oil temperature gauge starter generator transmitting equipment, special blue leather upholstering lux automatic fire extinguisher, two flying seat chutes, large gas tanks, landing lights, flares electric controllable propeller hand rubbed blue and cream finish Will sell with or without extra equipment Bargain will trade Stoner Mfg. Corp Aurora, Illinois. No 2

TAYLOR CUB E-2 Late 1934; slightly cracked Price $230 00 James F Kelley, Southold L. I, New York No 3

KELLETT AUTOGIRO—210 H P Continental motor—five hours since top overhaul—Relicensed to May first, thirty-nine Further information on request Herman Schram 2 Broadway, N Y C No 4

ONE CURTIS ROBIN OX 5 cabin 3 place Licensed, recently overhauled new paint very good condition Cheap Price F O B Lake Delton Airport, Lake Delton, Wis. Write for particulars R M Hines, Delivery notes, Lake Delton, Wis No 5

ENGINE MOUNT and oil tank for J 5 Travelair cowling for J 5 Travelair Taper Wing Waco Damaged Speed wing Travelair demaged Parts for 12 Q sport Travelair Waco-10 parts Travelair 2000-4000 parts J 5 engine parts. Kingsville Cabinet Shop Kingsville, Mo No. 6

WE ARE OFFERING for a limited time only a Free complete Transport Pilot Course with every new Monocoupe or Continental powered Aeronca purchased from St Joseph School of Flying, Dept A Municipal Airport, St Joseph, Missouri No 7

OX5 AMERICAN EAGLE, Licensed to April 1939 Completely millerized motor, dual controls. Fabric and appearance good $350 buys this ship L P Schroeder, 4551 Ray St Louis Mo No 8

AVRA AVIAN $400 00 is excellent flying condition air wheels compass new engine heads extra propeller Licensed to Sept 1938 E B Gorham 3459 Drummond Pl Chicago, Ill No 9

REARWIN 1936 LeBlond 70, brakes, carburetor heater Airplane and motor in beautiful condition. Write or wire Rearwin Airplanes Kansas City No 10

CURTIS JR Just relicensed New prop winter enclosure, very clean always hangared, latest pusher built $430 cash Gilbert Drew, 2305 Castellar Street, Omaha Nebraska No 17

LE BLOND 70 Perfect condition, unused since completely overhauled by factory Exceptional value Priced to sell Rearwin Airplanes Kansas City Kansas No 12

SAVOIA MARCHETTI 5 hours since major just relicensed April 1936 New bottom and complete new covering all instruments rebuilt at the factory This ship in first class condition and guaranteed as good as new Will accept Aeronca or Taylor Cub or part payment Raymond V Green Fulton N Y No 72a

WACO "10" Excellent condition Recently recovered striking paint job Vermillion, silver and white Dual controls air wheels, brakes available Motor recently overhauled Licensed to November 1938 Bargain for cash C R Galloway, 4521 El Campo St., Fort Worth Texas No 15

FRANKLIN SPORT VELIE 65 H P No time since major $695 C-2 Aeronca just relicensed $295 1936 C 3 Master Aeronca $725 Al Leeward New Kensington Pa No 14

FAIRCHILD 22 C/9 1934 Warner Scarab 40-125 H P engine air starter Hamilton prop wheel pants. No time on ship and engine since overhaul Licensed to May, 1939 Loening yellow, black trim high gloss Priced reasonably State Trade School Putnam, Conn No. 65

MONOCOUPE—LAMBERT R266 Motor just overhauled Ship perfect. Licensed till April, 1939 Sacrifice Donnelly 665 East 23rd St, Brooklyn N Y No 75a

OX5 SWALLOW ship all ready for relicensing. Motor just majored new prop wheels tires and covering total time 217 hours $285 fly away Ray Goetchius, 319 W Lake St, Winsted, Conn No 16

CUB 1937 MODEL just relicensed, airplane completely recovered engine just majored, finished all white steerable tail wheel navigation lights total hours 821 like new—$1050—W A Speer 3330 Barnett Ave, San Diego Calif No 17

1937 model REARWIN DELUXE 90 with 4 hours since factory major Will take 37 Cub, Taylorcraft, Aeronca or good used car in part payment Describe your trade accurately and fully in first letter Box 330 Indiana, Pa No 18

PRATT & WHITNEY HORNET T2D1 Engine—Total 302 hours. Two Hamilton controllable 2-M Propellers—diam 8'9" Used 102 804 hours rmp For use above engine or other with SAE 40 shaft. All spare component formerly owned maintained and overhauled by European airline company Unused since overhaul No 19

CUB 1937 Seaplane, metalized complete with Edo floats and landing gear enclosure water rudder extra fins and beaching gear just relicensed total hours 426 since major 75 hours perfect condition—$1450—W. A Speer 3330 Barnett Ave San Diego Calif No 20

EASTMAN AMPHIBIAN EXCELLENT condition motor majored system hundred fifty dollars New Orleans Air Lines, 1151 Lesseps Street New Orleans La No 20a

2 SIKORSKY S-38 Wasp t Motors Controllable Props—Twoway Radio Complete over water flying equipment Good condition ready to fly at Morrison Field, W Palm Beach, Fla. West Palm Beach Aero Corp No 21

CYCLONE ENGINE—Model SGR 1820-F3—700 H P at 1950 rpm 7000 feet—Only nine hours service since new—Bargain Price $5000 00 f o b Williamsport Service Department Aviation Manufacturing Corporation, Williamsport, Pa. No 22

AMERICAN EAGLE Long nose OX 5, flown ten hours since complete rebuild, recovering and motor overhaul New propeller Frank Bradley Jr, Lincoln Park, New Jersey No 23

RYAN—B5 J 6-9 MOTOR just completely majored at cost of $790 Wing recovered Plane completely dated for aerial mapping Sale price with motor $1500 Less motor $900 Standard Aerial Surveys Hackensack, N J No 24

FLEET MODEL ONE, Warner 125—just completely recovered, engine just majored, just relicensed, not restricted steel prop, large rudder, ship like new, finished all Loening yellow—$1950—W A Speer, 3330 Barnett Ave, San Diego Calif No 25

CHALLENGER ROBIN, A 1 condition $730; Whittelsey Avian, just rebuilt and majored $600, Fairchild 22, A 1 condition $1250; Fairchild 21 majored and perfect shape $1150; Lambert Monocoupe majored, $2200 Fledg Robin, and other parts Aircraft Brokerage, Flushing Airport, Flushing, L. I No 26

FREE AEROPLANE with motor purchase Easy terms, $12 50 down 200 pounds useful load Welded steel construction Propeller—all types—98¢ up Sensational values. Illustrated information, and flying manual 25¢ Universal Aircraft, Fort Worth Texas. No 27

FAIRCHILD 24 DE LUXE, Warner Engine, just majored Flaps, pants, Elec starter, brakes, generator, bank and turn, rate of climb clock steerable tail wheel excellent condition—$3750—W A Speer, 3330 Barnett Ave, San Diego Calif No 28

WACO 1934 Custom cabin Lights, flares bank and turn climb clock, radio, pants steel prop large tanks 5 place Insignia blue with cream trim 225 Jacobs, 1 year old 160 hours Never scratched Forced to sell cannot be told from new ship Dixie Airways, Inc. Shushan Airport, New Orleans La No 29

SIKORSKY S-39 Hamilton Standard Controllable. Plane and engine undergoing major overhaul for new license Will be finished to buyers specifications Late series model Partly modernized. Reasonable number of hours. Price well below market Heaney Laboratory, Hangar "C" Mineola, N. Y Roosevelt Field No 30

KINNER SPORTSTER—low wing Kinner 100 H P total hours 966 since major 200 hours starter, brakes. tail wheel Excellent condition—$1850—W A Speer 3330 Barnett Ave San Diego Calif No 31

FAIRCHILD 24c DELUXE WARNER flown since 1937 Demonstrator New appearance and condition throughout Flaps pants generator Act quickly Trade and finance Wedell & Smith City Airport Detroit, Mich No 32

STINSON SM8A 33 hours since motor major. Airwheels tailwheel compass lights starter. Licensed to June 1939 $1095 or will take light ship in trade Kenneth Richardson, Box 765, Menominee Michigan No 33

BARNSTORMER S POOL—Stinson "U" One ton payload Can be licensed for 15 or 14 Motors overhauled beautiful finish and condition Licensed May 1939 Will take trade No reasonable offer refused Make your own price FS 447 AVIATION 330 West 42nd St New York City No 33a

BEST ROBIN in U S Just relicensed completely overhauled recently First reasonable offer takes it. Ben Wilkinson Middle River, Maryland No 34

AERONCA C-3 purchased new December 1936 Engine overhauled Extra equipment looks like new. Complete $750 00 Mego, 10239 Calumet Avenue Chicago No 35

FAIRCHILD 32 Five place cabin Job less engine and instruments $350 00 Fuselage needs recovering, wings good FS-444, Aviation 330 West 42nd Street, New York City No 36

ONE TAYLORCRAFT DEMONSTRATOR 125 hours Our DeLuxe Taylorcraft—Many extras—with or without floats Trades accepted Meinke Eldred Flying Service, Lost Nation Airport Willoughby Ohio No 37

WACO 1933 CABIN $2 250 00 for quick sale, Continental 210 h p Motor modernized, lights, flares, 70 gallon gas tanks, bank & turn rate of climb wheel pants, steel propeller radio, The H C Robbins Company Cleveland Airport Cleveland Ohio No 38

CAPRONI 2 P O L B D H Gipsy Airwheels Oleo Airspeed Compass $650 00 Trade on car Lon Jacobson 154 East 87th Street, N Y C No 39

HISSO AND OX 5 engine parts at bargain prices Send us list of requirements and we will quote immediately Heckmann Company, 4026 West Lake Street, Chicago Illinois No 40

AERONCA C 3 SEAPLANE Just corrosion proofed recovered motor factory majored Very little total time, mostly on fresh water, none since overhaul. High gloss yellow finish at closeout Stainless steel throughout better than new Low cash price includes landing gear dock and ramp if desired F O B Connecticut P S 446, Aviation, 330 West 42nd Street New York City No 41

120 AEROPLANES—Maximum $800—Minimum $59 Flyables Repairables Easy terms Trades Send quarter for International Aeroplanes Directory Box 482 Pt Huron Mich No 42

1937 CUB DELUXE Seaplane-Landplane Like new Lots of extras Cost $2 200 00 new Bargain Sell Floats separate Al Leeward New Kensington Pa No 43

STINSON—MODEL S, 1931 A real bargain at $1,200 00 Lycoming 210 h p Landing lights. Licensed until June 1939 The H C Robbins Company, Cleveland Airport, Cleveland Ohio No 44

1934 STINSON SR5 Reliant Never cracked No time since complete major Wonderful condition Just relicensed Beautiful finish $2450 Al Leeward New Kensington Pa No 45

ARROW V-8 MASTER compass, brakes, tail wheel lights, carpeted 20 hours total modernized water pump large crankcase, Gullwings Licensed March 1939 Best used Arrow on market Will accept any reasonable cash offer J A Wales, Jr Stratford Conn No 46

FREE AEROPLANE with motor purchase Easy terms $12 50 down 200 pounds useful load Welded steel construction Propeller—all types—98c up Sensational values Illustrated information and flying manual 25¢ Universal Aircraft Fort Worth Texas. No 47

FAST AIRPLANES Two Lockheed Orions—Excellent condition—Airline equipped—Just relicensed Inland Air Lines Inc Casper, Wyoming No 47a

1937 Oct 15 Silver Cub Tailwheel. Enclosure. Wired, 132 hours total time Perfect condition very snappy motor $950 00 cash McCobb 155 Pennington St Quincy Mass No 47b

OX5 ROBIN, just completely rebuilt and recovered New Pyrlin cables etc licensed to July 1939 Priced for quick sale R N Dobbins 90 Pine St, Verona N J No 47c

WILL TRADE Have 1937 Chrysler Coupe ON Aircooled ship 100 H P up to 450 H P Must be licensed, in A1 Shape Also skywriting equipment O'Neil A Medore, (Fayette Co) Dunbar Pa No 47d

FAIRCHILD 24 3 place 1937 model 60 hours on ship New Warner engine Privately owned Good as new Price $4250.00 cash Can be seen at Candler Field Atlanta, Ga Reason for selling giving up flying Mr Ben T Pierce Chamblee Ga No 47e

WARNER FLEET MODEL 1 Airwheels turn and bank rate of climb color white and red Motor in excellent condition, price $1250.00 cash Robert H Talley 101 East Grand Ave, Marshall Texas No. 47f

Products

Books

BLONDIN S AIRCRAFT CHART Authentic questions answered 94 Pictures $1 00 Blondin Chart Co Box 34 Los Angeles Calif No 48

PILOTS QUIZ SYSTEM covers all pilot examination questions with answers including new regulations $2 00 Postpaid Quiz System 1435 Flower St, Glendale Calif No 49

INSTRUCTION for professional airmen Transport License Texts which take the drudgery out of study are published only by Thompson Aviation Publishers 8328 Woodward Ave, Detroit, Mich Write for literature. No 50

Office Equipment

OFFICE EQUIPMENT near half, Bargains in Typewriters Duplicators Adders Check Writers, Write for free list and Save Pruitt 998 Pruitt Bldg Chicago No 57

Parachutes and Pontoons

COMBINATION SET IRVING AIR-CHUTES, set pack and chest rebuilt at plant last August 24 ft Pongee silks Make me an offer Julius Sabo 1130 Seventh St Muskegon Heights, Mich No 51a

USED PARACHUTES bought sold and serviced Joe Crane Roosevelt Field, Mineola Long Island N Y No 32

PONTOONS FOR SALE. Edo Model 303 Hunter Company Shrine Bldg Memphis Tenn No. 52a

For Rent

OFFICE AND FACTORY space 7 000 to 25,000 square feet. Buildings by Acres Near United Air Craft. Box 1341 Hartford Conn No 54

KEENE AIRPORT For Rent or Lease to reliable party For further particulars communicate with Edward C. Sweeney Keene N H No 55

Page 90—Aero Ind Tech Inst 56
Page 92—Aircraft Directory The 56a
Page 92—Air Parts Inc 57
Page 91—Air Union 58
Page 92—Ambrose, Inc Frank 59
Page 67—Boeing School of Aeronautics 60
Page 92—Carlisle Louis G 61
Page 93—Consolidated Air Service 62
Page 95—Curtiss-Wright Tech Inst 62a
Page 92—Indiana Air Service 63
Page 93—International Derrick & Eq Co 64
Page 93—Irvin Aircraft Mech School 65
Page 91—Kollsman Instrument Co, Inc 65a
Page 92—Leech Aircraft, Inc 66
Page 95—Littlefuse Laboratories 67
Page 93—Luscombe School of Aero 68
Page 93—Mechanics Universal Aviation Service Co 69
Page 92—Mromco Manufacturing Co 70
Page 5—Parks Air College 71
Page 92—Parks Aircraft Repair Depot 72
Page 93—Phenix Aircraft Products Co 73
Page 92—Rankin, Tex 74
Page 94—Ryan School of Aeronautics 75
Page 92—Snyder Aircraft Corp 76
Page 92—Standard Aircraft Equipment 77
Page 92—Stinson Airplane Ex 78
Page 92—Sundorph Aeronautical Corp 79
Page 93—Supreme Propeller 80
Page 91—Thompson Aviation Publishers 81
Page 95—Titanine, Inc 82
Page 95—Tri State College 83
Page 95—Universal Alloy Products Co 84
Page 92—Vimalert Co Inc, The 85
Page 95—Warren School of Aero 86
Page 93—Wittek Mfg Co 87

Positions Vacant

IRISH AVIATION AER RIANTA, TEORANTA the Irish National Commercial Airline Company, is compiling a register of Irish citizens engaged in aviation, who would be willing if appointed to take up suitable positions in Ireland, or elsewhere under or on the occupation of the Company Applications should be in writing, address to the undersigned and should contain particulars of age, whether married or single where born (or other evidence of citizenship) professional qualifications and experience salary expected present employment and salary, and should be accompanied by copies only of testimonials, which will not be returned J F Dempsey Secretary 39 Upper O'Connell Street Dublin No 58

WANTED—INSTRUCTORS, Mechanical and Aeronautical engineering and mechanics Government approved school State qualifications, experience salary expected first letter Enclose snap-shot photo P445 Aviation, 330 West 42nd Street New York City

Services

EASTERN AERONAUTICAL CORP.—24-hour hangar service Mobilgas and Mobiloil, Airplanes for charter and sightseeing Also Stinson Lycoming Sales & Service Airport, Newark, N J No 53

Positions Wanted

GRADUATE, B S. degree desires opportunity in aviation. Major in aviation physics, minor mathematics. Two years of engineering drawing. Age 22. P W 441, Aviation, 330 West 42nd Street New York City

AIRPLANE ENGINE MECHANIC Federal licensed by U S Dept of Commerce, license No 12447 Former member of Army Air Corps holding rating Air Mechanic 1st Class Best of references furnished Available at once P W 443, Aviation 520 No Mich Blvd, Chicago

MECHANIC desires Airport Work in East Obed Malpass 1010 So Sixth St., Wilmington, Delaware

Representative Available

CANADA PROGRESSIVE ORGANIZATION assisted by manufacturing plants, open for exclusive agencies for instruments parts or equipment Trim Parts 738 Notre Dame St, W Montreal

BUSINESS OPPORTUNITY

Patents for Cooling System & Engine

FOR SALE OR PART CASH and royalty best offer Patents—Air (self) cooling system for engines. Manufacturing tools drawings, patterns 8 Cyl opposed horizontal engine 500 horse flight, positive cooling Can be used on any type engine Manufacturing cost nominal Must make deal C M Ashmussen, 2045 No 19th Street Omaha Nebraska

WANTED A BACKER! for a new type of aircraft design If you can drive a car you can fly this ship Act at once, you have from now to Jan. 1939 to decide, we sail for a foreign country then B O 440

U. S. Government

WAR DEPARTMENT Materiel Division, Air Corps, Wright Field Dayton Ohio Office of the Contracting Officer —The War Department invites the submission in competition of sealed bids covering airplanes under conditions set forth more particularly in the following advertisement Circular Proposal No. 38–480 dated March 8 1938 Airplanes, Attack (Single Engine), described in U S Army Specification No 98–109-E dated December 21, 1937, bids to be submitted to the Contracting Officer not later than 1 00 P M. Eastern Standard Time March 8, 1939 Full particulars with respect to said advertisement may be obtained upon application to the Contracting Officer Wright Field Dayton Ohio E T Kennedy Major Air Corps Cont. Officer

Continued on page 92

Continued from pages 88 and 91

Continued on pages 94 and 95

RYAN is the *only* commercial flying school in America which offers its students a fleet of modern, metal ships. Eight of the eleven planes used for student training at the Ryan school are the latest Ryan S-Ts and Ryan S-Cs, none of which is more than two years old.

Ryan S-Ts with 125 h.p. engines are the same as the ship in which Tex Rankin won the International Aerobatic Contest in 1937. The Ryan S-C is the new 3-place cabin plane first displayed at the Chicago Aircraft Show and accepted as the industry's most modern medium sized cabin ship.

Ryan S-Ts and Ryan S-Cs include these modern features:

Metal construction similar to modern transports.

Low wing design similar to modern transports.

Flaps and tabs similar to modern transports.

Tandem seating (Ryan S-Ts) similar to military trainers.

Unsurpassed vision. Cruising speeds 127 to 135 m.p.h. Top speeds up to 150 m.p.h.

Consider carefully the type of equipment in which you will learn to fly. No flying school can be called modern that is not using late type modern equipment. Compare the equipment at Ryan with that offered at other schools and learn why students prefer Ryan School of Aeronautics with its modern facilities, friendly, capable instruction, direct affiliation with extensive aircraft manufacture and ideal location in San Diego with the greatest annual flying of any city in the United States.

RYAN FLYING MECHANICS ENGINEERING

SCHOOL OF AERONAUTICS

LINDBERGH FIELD, SAN DIEGO, CALIF. AV 7

Please send information on courses checked with revisions in conformity with new Civil Air Regulations:

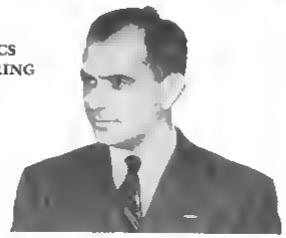
FLYING COURSES
- ☐ Master Pilot
- ☐ Commercial (formerly transport)
- ☐ Limited Commercial
- ☐ Private
- ☐ Solo (formerly Amateur)
- ☐ Deluxe Combination—includes a new Ryan S-T A plane with complete commercial course.

GROUND COURSES
- ☐ Aeronautical Engineering
- ☐ Airplane Drafting and Design
- ☐ Master Mechanic
- ☐ Master Mechanic and Flying
- ☐ Aircraft Welding
- ☐ Advanced Navigation
- ☐ Master Radio

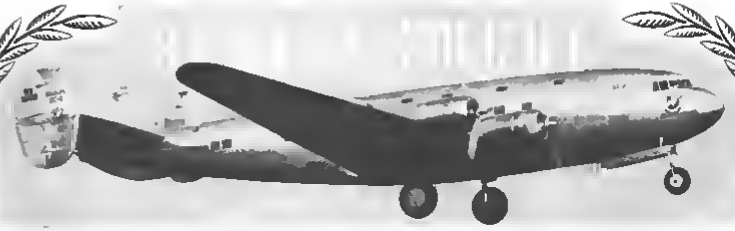
Name_____ Age_____

Address_____

City and State_____



T. CLAUDE RYAN—manufacturer, pilot, educator with 21 years of aviation experience. Founder of aircraft companies bearing his name, the products of which include Lindbergh's "Spirit of St. Louis," and today's most modern, metal, sport training and cabin planes. President, Ryan Aeronautical Company, and Ryan School of Aeronautics.



The great Douglas DC-4 (weight 65,000 lbs.) leaving the ground for the first time as seen by the astute Curtiss-Wright Tech student body. Note tricycle landing gear.

MORE CURTISS-WRIGHT TECH GRADUATES WORKED ON THE DC-4

than those of any other school. Curtiss-Wright Tech does not guarantee positions for its graduates—no reputable school would—BUT

Mr. Donald Douglas

PRESIDENT OF THE DOUGLAS AIRCRAFT CO. SANTA MONICA CALIFORNIA

Says IN A LETTER TO MAJOR C. C. MOSELEY

". . . . . During the past several years, we have employed a large number of your graduates and have found them to be eminently satisfactory. Efficient workmen capable of working with the care and precision demanded by the Douglas Aircraft Company are the product of thorough training and are difficult to find. You are to be congratulated on the fine job your Institute is doing in turning out such men. . . . . ."

No higher compliment can be paid Curtiss-Wright Tech and its graduates —nor is there any higher authority than Mr. Douglas.

Curtiss-Wright Tech is APPROVED by the U. S. Government, ACCREDITED by the State Board of Education ENDORSED by the Aircraft Industry and offers specialized training only in

AERONAUTICAL ENGINEERING OR MASTER MECHANICS

Practical training for your career in the heart of the Aircraft Industry. The only U.S. Government approved school of its kind in Los Angeles County. No flying involved. Approved by the U.S. Department of Immigration for non-quota foreign students.

BE WISE — PROTECT YOUR FUTURE

MAIL TODAY! Without obligation please send me catalog and information on the courses I have checked DON'T DELAY!

MAJOR CAREER COURSES

AERONAUTICAL ENGINEERING—An advance course for a highly paid professional career in designing and engineering modern all-metal planes.

MASTER MECHANICS—Complete course for a successful career in airline maintenance or factory production. Embraces all mechanics, including aircraft sheet metal work.

SUPPLEMENTARY COURSES

POST GRADUATE ENGINEERING—(for engineers holding B.S. degrees.) To enable graduate B.S. engineers to convert their previous training into Aeronautical Engineering without again covering math, drafting theory and fundamentals of stress analysis.

AIRCRAFT SHEET METAL—gives a training in aircraft factory sheet metal work accepted standard and most modern practices.

HOME STUDY DRAFTING—Prepares you as a Draftsman for after all factories. All manufacturing starts on the drafting table.

NAME_____ Age_____ Date I Plan to Enroll_____ Ar 17

ADDRESS_____ City_____ State_____

CURTISS-WRIGHT TECHNICAL INSTITUTE

UNDER PERSONAL SUPERVISION OF MAJOR C. C. MOSELEY, PRESIDENT

GRAND CENTRAL AIR TERMINAL, GLENDALE (LOS ANGELES) CALIFORNIA

INDEX TO ADVERTISERS

Aero Industries Technical Institute, Inc	80
Aeronca	56
Aeronautical Corp of America	56
Aircooled Motors Corp	49
Aviation Equipment & Export, Inc.	86
Aviation Manufacturing Corp	46
American Chain & Cable Co, Inc	58
Aluminum Company of America	9
B G Corp The	38
B H Aircraft Co.	88
Berry Brothers	88
Bendix Products Corp.	16
Bendix Radio Corp	Second Cover
Black & Decker Mfg. Co The	8
Boeing School of Aeronautics	67
Consolidated Aircraft Corp	12
Continental Motors Corp.	50
Colonial Beacon Oil Co Inc	14
Douglas Aircraft Co, Inc	77
Dart Manufacturing Corp	86
Dzus Fastener Co., Inc	88
Classified Advertising	90-95
Curtiss Propeller	57-61
Curtiss Wright Corp	57-61
Eclipse Aviation Corp	Back Cover
Edo Aircraft Corp	86
Ethyl Gasoline Corp	82
Fleetwings Inc.	89
Goodrich Co, The B F	42-43
Goodyear Tire & Rubber Co	85
Gulf Oil Corp	34
Gulf Refining Co	34
Grumman Aircraft & Engineering Corp	4
Hazard Wire Rope	99
Henschel Flugzeug Werke A G	89
International Derrick & Equipment Co	95
International Nickel Co Inc, The	10
Kendall Refining Co	Third Cover
Kollsman Instrument Co	49
Lear Developments Inc	87
Littelfuse Laboratories	93
Lockheed Aircraft Corp	62
Lycoming	46
Macwhyte Co	79
McGraw-Hill Book Co Inc	50
Martin Co., The Glenn L	65
Norma Hoffman Bearings Corp	81
Pacific Airmotive Corp	88
Phenix Aircraft & Products Co	93
Pioneer Instrument Co Inc.	83
Piper Aircraft Corp	45
Parks Air College	5
Pump Engineering Service Co Inc.	86
Pyle-National Co, The	80
Radio Frequency Laboratories Inc	80
Roeing Pump Co	84
Scintilla Magneto Co Inc	96
Stinson Aircraft Corp	3
Standard Oil Co of New Jersey	14
Standard Oil Co (Ohio)	14
Standard Oil Co (Inc of Kentucky)	14
Standard Oil Co of Louisiana	14
Standard Oil Co of Penna	14
Stearman Aircraft	74
Solar Aircraft Co	84
Superior Propeller Co	95
Switlik Parachute & Equipment Co	84
Texas Co, The	6-7
Titanine Inc	93
Ulmer Co The J C	86
United States Aviation Underwriters Inc	89
Esso	14
United Aircraft Corp	
Hamilton Standard Propellers	73
Pratt & Whitney Aircraft	Front Cover
Sikorsky Aircraft	70
Warrak Mfg Co	93
Universal Alloy Products Co	93
United States Plywood Corp	78
Wellington Sears Co	86
Western Electric Co	97
Wright Aeronautical Corp	57-61

SCHOOLS

Aero Industrial Technical Institute, Inc.	90
Boeing School of Aeronautics	92
Consolidated Air Service	92
Curtiss Wright Tech Inst	92
Irvin Aircraft Mechanics School	93
Luscombe School of Aeronautics	93
Mechanix Universal Aviation Service, Inc.	91
Parks Air College	8
Ryan School of Aeronautics	91
Tri-State College	92
Warren School of Aeronautics	92

CLASSIFIED ADVERTISING

BOOKS	91-92
EMPLOYMENT (Positions Wanted and Vacant)	91
FOR RENT	91
FOR SALE (General)	91 92 93
INDEX of Planes, Engines and Parts For Sale	90
PRODUCTS	91
SERVICES (Charter, Instruction, Repairing, Storage)	90 91
WANTED TO PURCHASE	91

DISPLAY ADVERTISERS

Aircraft Directory The	92
All Parts, Inc.	92
Ambrose, Inc Frank	92
Carlisle, Lewis E	92
General Air Service	92
Indiana Air Service, Inc.	93
Kollsman Inst Co. Inc.	91
Leech Aircraft Inc.	92
Manmee Manufacturing Co.	92
Parks Aircraft Repair Depot	92
Pilot's Union	91
Rankin Tex	92
Simmonds Gov't Corp. Ltd	91
Snyder Aircraft Corp.	92
Stanford Aircraft Equipment	92
Stinson Airplane Exchange	92
Swedeman Aeronautical Corp	92
Thompson Aviation Publishers	91
Vienlort Co., Inc., The	92

BUY ACCO QUALITY

Regardless of your control requirements—specify—

HAZARD

Ever since aviation became an industry, Hazard has been preeminent as a supplier of control cable or strand. At first Hazard's tinned and galvanized aircraft cable was the accepted standard. More recently Hazard developed "KORODLESS" preformed cable—made entirely of 18-8 stainless steel. This new cable gained immediate recognition with the Navy and with all builders of craft where corrosion might be a problem.

For certainty of performance—for positive control—specify Hazard Aircraft Cable. It is made by the people who are "in business for your safety."

HAZARD WIRE ROPE DIVISION
ESTABLISHED 1848
AMERICAN CHAIN & CABLE COMPANY, Inc.
WILKES-BARRE, PENNSYLVANIA
District Offices: Pittsburgh, Chicago, Birmingham, Denver, Los Angeles, San Francisco, Philadelphia, Fort Worth, Tacoma, New York

A FEW OF THE 137 AMERICAN CHAIN & CABLE INDUSTRIAL PRODUCTS

AMERICAN CHAIN DIVISION
(DOMINION CHAIN COMPANY Ltd., in Canada)
Weed Tire Chains • Welded and Weldless Chain • Malleable Castings • Railroad Specialties

ANDREW C. CAMPBELL DIVISION
Abrasive Cutting Machines • Flexformers Special Machinery • Nibbling Machines

FORD CHAIN BLOCK DIVISION
Chain Hoists • Trolleys

HAZARD WIRE ROPE DIVISION
Lay-Set Preformed Wire Rope • "Korodless" Wire Rope • Preformed Spring-Lay Wire Rope • Guard Rail Cable

HIGHLAND IRON & STEEL DIVISION
Wrought Iron Bars and Shapes

MANLEY MANUFACTURING DIVISION
Automotive Service Station Equipment

OWEN SILENT SPRING COMPANY, Inc.
Owen Cushion and Mattress Spring Centers

PAGE STEEL AND WIRE DIVISION
Page Fence • Wire and Rod Products Traffic Tops • Welding Wire

READING-PRATT & CADY DIVISION
Valves • Electric Steel Fittings

READING STEEL CASTING DIVISION
Electric Steel Castings, Rough or Machined

WRIGHT MANUFACTURING DIVISION
Chain Hoists • Electric Hoists and Cranes

In Business for Your Safety

HAZARD *Aircraft* CABLE

FRANK FULLER AND HIS SEVERSKY PLANE

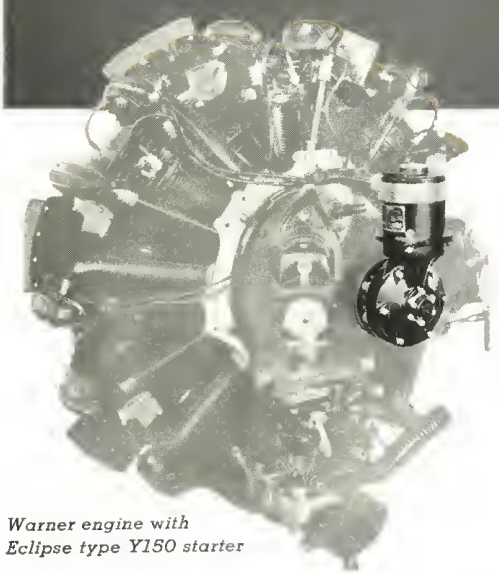
Frank W. Fuller, Jr., in his Seversky plane won the 1937 Bendix Trophy Race and established a new record by covering the distance from Los Angeles to Cleveland in an elapsed time of 7 hours 54 minutes and 26 seconds, using Kendall the 2000 Mile Oil. His average speed was 258.242 miles per hour. From Cleveland, he continued to Bendix, N.J. to establish a new trans-continental record of 9 hours and 33 minutes. On May 28, 1938, again using Kendall Oil, Mr. Fuller established a new Vancouver-to-Oakland record of 3 hours 8 minutes and 43 seconds, an average speed of approximately 270 miles per hour.

FOR NINE CONSECUTIVE YEARS, users of Kendall Oil have won more prizes at the National Air Races than the users of all other oils combined. Such a record proves conclusively the dependability of Kendall Oil. It is significant that when Mr. Fuller stopped at Kansas City in his Bendix dash, he found it necessary to add only 3 quarts of Kendall Oil after five hours of 272 M.P.H. flying. Kendall Oil is refined by special processes 100% from Bradford Pennsylvania Crude, the world's choicest. It comes to you in individually numbered, refinery-sealed cans, which protect its quality from contamination. It is available at most airports throughout the country.

KENDALL REFINING COMPANY, BRADFORD, PENNA. • KENDALL REF. CO. OF CANADA, LTD., TORONTO

23 Fairchilds for the Bureau of Air Commerce

ECLIPSE EQUIPPED for Reliable Starting



Warner engine with Eclipse type Y150 starter

The recent purchase of twenty-three Fairchild "24" airplanes by the United States Bureau of Air Commerce, is the more gratifying to all concerned because of the unusual amount of investigation and analysis which preceded the selection. Among the Eclipse products which will share this exacting service are Eclipse Electric Starters. No finer evidence of keen engineering discrimination could be found, than time-proved Eclipse starting equipment.

ECLIPSE AVIATION CORPORATION

(Subsidiary of Bendix Aviation Corporation)

EAST ORANGE, NEW JERSEY